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## TULAREMIA: A COMPARATIVE STUDY OF FOUR CASES ORIGINATING IN MINNESOTA\*

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A NEW disease, discovered by Americans, one of few infections transmitted from lower animals to man directly or indirectly through the medium of parasites, a disease appearing in four distinct and characteristic forms, with a morbidity and mortality toll as serious as that of typhoid fever, resistant to all present forms of therapy, and occurring in an alarming and increasing frequency in all parts of the country—all these facts make the study of tularemia one of the most interesting and outstanding developments in clinical medicine in the past decade.

Tularemia is primarily an acute infectious disease of rodents and wild rabbits and secondarily a disease of man.

### HISTORY

In 1907 Dr. Ansel Martin of Phoenix, Arizona, described some cases in man as "rabbit septicemia" which, judging from their clinical course, and the fact that two of these cases still give typical agglutination tests, were doubtless cases of tularemia.

In 1910 Dr. R. A. Pearse of Utah referred to a disease of rabbits transmissible to man.

Since 1911 a disease called "deerfly fever" has been recognized as a clinical entity in Utah.

In 1912 McCoy and Chapin described the disease in rodents and isolated the causative organism and named it *Bacillus tularense*. It was so named after Tulare County, California, in which it was discovered.

In 1919-20 Francis isolated the organism from human cases, identified it with that found in rodents, and named the disease "Tularemia" on account of the presence of the *B. tularense* in

the blood. In 1925 Francis published a very comprehensive description and classification of the various clinical forms of the disease.

Since then, numerous cases have been reported from over half of the states of the Union. Francis reported 295 cases up to March, 1927.

Ohara reported a similar, possibly identical, disease in Japan in 1925.

Dr. Rutledge of Detroit, Minnesota, reported the first case originating in this State, which occurred in his practice in August, 1926.

In nature, tularemia occurs in wild rats, ground squirrels, wild rabbits (snowshoes, cottontails and jackrabbits). The organisms are found in horseflies or deerflies, wood ticks, bedbugs, and the rabbit louse. It also occurs about the mouths and teeth of animals that have eaten or bitten diseased rodents or rabbits.

It may be transmitted to man by: (1) handling of diseased animals; (2) contamination of the hands or conjunctiva with the tissues or body fluids of diseased animals; (3) the bite of diseased animals; (4) contamination of the hands or bites of flies, ticks, bedbugs, or lice which have bitten diseased animals; (5) the bite of any animal that has eaten diseased rodents or rabbits. The only case in which transfer from man to man has occurred was reported by Harris, in which the mother was believed to have been infected through a prick of her thumb while dressing an ulcer on her son's hand. The organism apparently has the ability to penetrate the unbroken skin or conjunctiva; but a frequent portal of entry is a wound existing before contact or occurring at the time of contact. Laboratory workers are very prone to contract the disease. A report of four cases by Freese and Francis in February, 1926, would suggest the possibility of infec-

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tion from eating insufficiently cooked rabbit meat, although thorough cooking kills the organism.

The causative organism is gram negative, non-motile, and non-spore bearing, occurring in both bacillary and coccoidal forms; the older the culture is, the more the coccoidal type prevails. It occurs early in the disease in the blood of the lower animals as well as in man and in the coelomic fluids of the above parasites. It grows well on coagulated egg-yolk and blood glucose cystine agar, but not on ordinary media. Cover-glass preparations stain best with aniline gentian violet. In sections of tissue it stains best with Giemsa's solution.

The incubation period varies from twenty-four hours to nine days; in most cases three or four days.

The onset is sudden, with severe headache, chills, fever, nausea and vomiting, general pains, sweating, and prostration. Francis states that fever is always present and tends to be characterized by an initial rise for one to three days followed by a remission of fever and other symptoms for one to three days, followed by a secondary rise which gradually declines to normal, the whole febrile period lasting two to three weeks. The local symptoms depend upon the clinical type of which Francis has described four.

In the ulcero-glandular type there is pain, tenderness, and slight enlargement of the lymph glands draining the portal of entry. When no wound is present, about twenty-four hours after symptoms begin, a painful papule appears at the site of infection, which breaks down and a necrotic core leaves a punched out ulcer with raised edges. When a wound is present, what appears perhaps as an insignificant or healing wound becomes freshly inflamed, necrosis of the center takes place, leaving a punched out ulcer which heals slowly. Red streaks may extend from the wound with subcutaneous nodules along the lymphatics. The glands break down in about half of the cases.

In the oculo-glandular type the symptoms are similar except that the portal of entry is in the conjunctival sac. At first there is irritation, lacrimation, local edema and usually first a papule then an ulcer on the inner surface of the lower lid. The lymph glands of the face and neck, the salivary glands and in some cases the axillary glands become swollen and tender.

The constitutional symptoms are similar to those of the ulcero-glandular type except possibly more severe.

In the glandular type the same glandular and systemic symptoms occur, but there is no ulcer or wound. This type is seen most frequently in laboratory workers.

In the typhoidal type, fever is the only outstanding symptom, there being no glandular or localized symptoms.

There has been a definite skin eruption reported in twelve cases which was macular, papular, or pustular.

The systemic symptoms are essentially the same in all types, the acute period lasting two to four weeks, followed by a period of prostration or very slow recovery lasting from three weeks to several months.

**Prognosis.**—The period of disability is rarely less than a month. While the mortality rate is not high, every now and then a fatal case occurs. Rutledge's case was the eighth fatal case in the United States up to August, 1926. Since then several have been reported. The morbidity is uniformly high.

**Diagnosis.**—Tularemia is most frequently confused with typhoid fever because of the similarity in the symptoms and the tendency to a moderate leukocytosis if any and a low pulse-temperature ratio. It may be confused with septicemia on account of the infected wound and glandular symptoms. It may simulate tuberculosis on account of the character of the lesions in the lymph glands. It may be called "undulant fever" or Malta fever on account of cross agglutination with *B. abortus* and *B. melitensis*.

The following facts are valuable in establishing a diagnosis: (1) a history of contact with rabbits or rodents or of bites; (2) a primary papule or wound developing into a punched-out persistent ulcer, or a primary conjunctivitis followed by an ulcer; (3) persistent local glandular enlargement; (4) fever of two to four weeks duration; (5) negative Widal; (6) a relatively low leukocyte count. The diagnosis is practically proven by an agglutination of *B. tularensis* by the patient's serum. This is being done by the Minnesota State Board of Health Laboratory at Minneapolis and at the Hygienic Laboratory at Washington, D. C.

One attack apparently confers immunity in man.

**Prophylaxis.**—Laboratory workers, cooks, market men and hunters should wear gloves when handling rabbits. In infected areas the public should be warned not to expose themselves to danger. Therapy up to the present is symptomatic. Rest in bed is the most important. Glands should be incised or excised only after they have softened.

**Pathology.**—In man, subacuteness approaching chronicity is characteristic of the ulcers, the regional lymph glands and the subcutaneous nodules along the lymphatics and of the small nodular lesions in the spleen, liver, kidney and adrenals.

I wish to make a comparative study of four cases of tularemia which have come under my observation—the first four cases I believe to be reported as originating in the State of Minnesota.

#### CASE REPORTS

The first case was seen in consultation with Dr. Lloyd Rutledge of Detroit Lakes, Minnesota, on September 3, 1926, and reported by him in MINNESOTA MEDICINE in February, 1927. With his permission I wish to review the salient features of the case.

**Case 1.**—Mrs. J. H., aged 59, lived three miles from Detroit Lakes, Minnesota, and was taken care of at her country home. In order to illustrate the difficulty with which a correct diagnosis was made, the writer shall not follow the usual order but will give the data in the order in which they were obtained. On August 27, 1926, the patient became acutely ill with severe headache, backache, vomiting of bile and temperature which rapidly mounted to over 102. She felt very sick and went to bed. On the next day pain developed in the right upper abdomen and there were chills and a rise of the temperature to 104.6. The leukocyte count was 5,000; Widal negative. On the third day the stools became frequent and of peasoup character. The patient complained of feeling very tired. At that time a small wound was noted on the left thumb. This was opened and some pus escaped. Slight cough occurred upon turning over. She complained of feeling very tired. On the fourth day the wound was more angry, and more pus was present. Dyspnea increased, respiration was 28, temperature 102. The glands in the left axilla now became enlarged, hard and quite tender and the patient became extremely weak. The leukocyte count was now 12,500. On the fifth day there were peapoup stools containing blood. There was some tenderness over the gall bladder region. Some epistaxis occurred. The writer was called in consultation. I found her extremely ill, having all the appearance of a severe case of typhoid fever. There were râles but no dullness in the chest, tenderness but no rigidity over gallbladder region and tenderness over the right ribs. There was a punched out ulcer in the wound on the thumb with

a necrotic floor which seemed to burrow back under the walls. Distinct beading could be felt and seen along the lymphatics up the forearm. Epitrochlear and axillary glands were enlarged, discrete, non-fluctuating and quite tender, though not as tender as is usual in a case of streptococcus infection. In going over the events preceding the onset of illness several incidents had taken place which tended to confuse us. Four weeks before the onset of illness she had been at a summer resort and had drunk water, of the purity of which she was not sure. Three weeks before, she had fallen down stairs severely injuring her right side just below the rib margin, and bruising her head, arm and leg so that she was black and blue for days; in fact, she had not felt very well since the injury. On several occasions in the past two years she had had pain in the right upper quadrant and on one occasion a physician had diagnosed gallbladder disease. About two weeks before, she cut her left thumb on a tin can but the wound had practically healed. One week before, she had gone to a fair and had drunk some lemonade which made her and three other members of the family quite ill with an acute diarrhea. The writer agreed with Dr. Rutledge that this was a peculiar case, not typical of anything we had ever seen, but that it should be treated as a case of typhoid fever until further Widal tests might confirm or rule out that diagnosis. However, we could not ignore the possibility of septicemia, in view of the acute symptoms in the infected hand, and every possible means was used to combat that infection. Just before leaving the house the writer recalled having read something about tularemia and upon inquiry I found that the patient had dressed a cottontail rabbit on August 21st, six days before the onset of the illness, but that the flesh of the rabbit was apparently normal and was eaten by the entire family. On account of never having heard of a case of tularemia in this part of the United States and not knowing much about it, the diagnosis of tularemia was not seriously considered at that time. Blood for a second Widal was taken and found negative. Cultures of the stool and urine were made on Endo's media and no acid producing colonies were found. Blood cultures were negative on broth and plain agar. The patient continued to grow worse with a temperature ranging around 102, extreme prostration and delirium. The ulcer on the hand did not heal. Vesicles developed on the buttocks. On the ninth day a papular eruption occurred and on the twelfth day about two dozen pustules very much like those of smallpox except that they were not umbilicated and were more superficial developed on the trunk and thighs. When the laboratory tests all failed to confirm the diagnosis of typhoid fever or septicemia and after reading Francis' article in the Journal of the A. M. A. of April, 1925, again the writer was convinced that this was a case of tularemia and telephoned Dr. Rutledge to that effect and suggested that blood be sent at once to the Hygienic Laboratory at Washington, D. C. Dr. Wm. Long of Fargo was called in consultation in the meantime and I understand that he also considered tularemia as a possibility. By that

time the patient's condition was so poor that blood was refused. The patient died on the fourteenth day of illness. Autopsy was not obtained. Blood was taken from the brachial vein after death and it was found to agglutinate the *B. tularensis* in dilution from 1:10 to 1:320 and produced typical lesions in guinea pigs. Bodies of rabbits found dead in the neighborhood were sent to the laboratory and they likewise gave positive agglutination tests and produced characteristic lesion in guinea pigs. A letter from Dr. Francis of the United States Public Health Service informed us that this was the first case of tularemia in Minnesota and the eighth fatal case on record in the United States. The writer reported the case to the staff of St. Luke's Hospital of Duluth a few days later.

Case 2.—J. L., married, aged 63, entered St. Mary's Hospital, Duluth, Nov. 16, 1926. I saw him at the invitation of Dr. Hirschboeck. He skinned a rabbit which he shot in township 14, Eagle Lake, St. Louis County, Minnesota, Sunday, October 30, 1926. At the time, he had a small cut on the forefinger of the left hand. On the following Tuesday he developed chilliness, felt "grippy" and had a slight cough. He came to Duluth, where he was seen about a week after onset, complaining of cough with very little expectoration, marked weakness, and fever. He entered the hospital on the sixteenth day of the illness.

His past history was of no interest except that he stated that he had had typhoid fever twice, at twenty-one and again at thirty-four years of age.

Physical examination showed a poorly nourished man, appearing older than his age. The skin was dry, but no rash was present. Movement or even talking tired him. A dry but only slightly productive cough was present. No conjunctivitis was present and only a suggestion of exophthalmos was noted. The left pupil was larger than the right, and pupillary reflexes were sluggish to light and accommodation. The mouth was dry; the tongue slightly coated. The chest was normal except for wheezing dry râles in both bases. The heart was normal. In the abdomen no masses nor tenderness was present.

On the left forefinger was a small cut with edges undermined and a small amount of dirty gray pus underneath. The ulcer was indolent in appearance, there being no great amount of swelling, redness or tenderness. On the twenty-ninth day the ulcer had apparently healed over but upon close examination slight fluctuation was discovered and upon opening it a small amount of dirty gray pus was expressed from the deeper tissues. The pus had a tendency to burrow deep into the tissues very much like a lesion of impetigo contagiosa. This pus could be expressed each day for several days. There were four or five axillary lymph glands, varying from the size of a hazel nut to a small walnut, discrete, movable, not fluctuating, only slightly tender. The epitrochlear gland was also palpable. X-ray showed diffuse shadows about the bronchi in both bases. The hemoglobin was 80 per cent and the erythrocyte count 4,500,000 upon admission—70 per cent and 3,710,000 respectively on discharge. The leukocyte count was 4,000

on the fifteenth day of the disease, 11,400 on the seventeenth, 8,000 on the twentieth, 16,300 on the twenty-eighth, 8,100 on the thirtieth, 8,700 on the thirty-eighth and 8,000 on the fifty-eighth day of the disease. The differential count was, p.m.n. 61, lymphocytes 35, transitionals 3, basophiles 0, eosinophiles 0, on the seventeenth day of disease, and 67, 25, 6, 0 and 2 respectively on the twenty-seventh day. The Widal was negative on the thirtieth day.

The agglutination to *B. tularensis* was positive in dilution of 1:10 on the twenty-second day of the disease and in all dilutions up to 1:640 on the thirtieth day.

While in the hospital the patient was very weak, at times irrational. He was so sick, he looked as if he was going to die. His temperature varied from 97.4 to 102.4, showing no tendency to afternoon rises. Prostration was extreme. Headache, backache, and tendency to perspire profusely were prominent symptoms. His condition began to improve on the thirtieth day.

Recovery was gradual, the patient leaving the hospital after being there forty-five days. The glandular enlargement persisted for some time afterward. Two months afterward he still complained of lack of strength, although he had gained weight and looked well.

Case 3.—The third case was seen in consultation with Dr. D. E. Seashore of Duluth on December 2, 1926. Mr. O. S., aged 54, Swedish, married, came to St. Luke's Hospital on November 29, 1926. On about November 10th he had cut his finger while slicing bacon. On November 12th he skinned a snowshoe rabbit which had been killed thirty-five miles north of Duluth. On November 15th, while at work, he suddenly became very ill with fever and weakness. He staggered and fell while walking home. That night he had a severe headache. He was very ill for two or three days and then felt better for two or three days. About ten days after the onset the finger became sore and the glands in the axilla became enlarged and tender. Extreme weakness was the most prominent symptom. The most acute symptoms had subsided before entering the hospital November 29th. While in the hospital he had headache, irregular fever varying from 99 to 101.6, pulse from 72 to 84. He felt very weak and exhausted and perspired freely. The ulcer on his hand healed very slowly, a thin dirty gray pus in small amounts being removed several times, when healing had practically closed up the wound. The glands were somewhat tender on the thirtieth day.

Physical examination revealed a punched out indolent ulcer on the finger with a somewhat elevated hard margin, a floor of necrotic material and discharging upon pressure a thin dirty gray pus, with enlarged and tender epitrochlear and axillary glands which did not fluctuate and were discrete and movable. The patient looked very toxic and had the general appearance of a moderately severe case of typhoid fever. Smears from the wound on the twentieth day showed staphylococci. On the twenty-third day the urine was normal except for a trace of albumin; the Wassermann and

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Widal reactions were negative the twentieth day. The agglutination to *B. tularensis* was positive in the dilution up to 1:320 on the seventeenth day of the disease.

Recovery was gradual, the patient leaving the hospital after being there sixteen days. Six weeks after leaving the hospital the axillary glands softened and spontaneously ruptured, liberating a copious amount of thin gray pus. This drained for nearly a month, after which the glands disappeared. Marked weakness persisted, so much so that he was unable to go to work until July 1st, seven and one-half months after the onset of the disease, and it was nearly nine months before he had entirely regained his strength.

**Case 4.**—The fourth case was Dr. Bardon's, who has kindly permitted me to include the case in this study. Mr. V. B., a Finn, aged 53, worked on a fox farm. On July 26, 1927, he became acutely ill with fever, chills, general malaise, nausea, and vomiting. He entered the hospital in a neighboring town on July 28th, at which time he was cyanotic and very ill. His temperature at that time was 101.4, the urine showed a trace of albumin and a few casts. A few dry râles were found throughout the lungs. A slight systolic murmur was present at the heart apex. The picture resembled typhoid fever but a Widal was negative. The following day his temperature dropped to 99.6 and he was lethargic. The albumin in urine was markedly increased. The lungs still were full of coarse dry râles. That night he became markedly delirious. On the fifth day of the disease he was somewhat brighter and was taken from the hospital. He was brought to St. Mary's Hospital, Duluth, on August 4th, severely ill, irrational and unable to give any history.

Physical examination showed a man, aged 53, apparently in a state of extreme prostration, breathing 40 times a minute, with a pulse of 104 and a temperature of 104.4 and blood pressure of 108/68. There were a few scattered pustules on the chest, arms and abdomen. No rose spots were seen. The eyes and conjunctiva were normal. Nose and throat also were normal. The teeth were in poor condition. No adenopathy was present in the neck. Some impaired resonance and râles were present over the entire left chest. A to and fro rub was heard in the left axilla which extended around anteriorly. Breath sounds were not greatly changed. The right lung apex was slightly dull posteriorly. There was a markedly accentuated pulmonic second sound heard in the fifth interspace, 11 cm. from the midline. A long blowing systolic murmur was present over the entire precordium and in the left axilla. The right heart border was out 5 cm. from the midline. The liver margin was down three fingers' breadth below the costal margin, but was not tender. The spleen was not palpable. The extremities were normal except for a small ulcer on the skin of the middle finger of the left hand with a small amount of cloudy purulent exudate and a much enlarged epitrochlear lymph gland on the same arm.

On August 6th the Widal was negative. The blood showed urea 10 mgm., creatinin 1.5 mgm. The urine was normal except for the presence of two plus albumen. The leukocyte counts were 17,200 (Aug. 3rd),

16,000 (Aug. 5th), 11,800 (Aug. 6th), 17,800 (Aug. 7th). The hemoglobin was 80 per cent. The differential count showed p.m.n. 88, lymphocytes 11, transitionals 1, basophiles 0, and eosinophiles 0 per cent.

In the differential diagnosis tularemia; encephalitis, meningitis, heat stroke and broncho-pneumonia were considered. Blood was sent to the Minnesota State Board of Health Laboratory for an agglutination test, coming back positive in the dilution of 1:160 and partial agglutination at 1:320.

The patient's condition grew rapidly worse until he died on the fifth day in the hospital and the fourteenth day of his illness.

A post-mortem examination was made by Dr. Berdez, Pathologist of St. Mary's Hospital, Duluth. The outstanding pathological findings were the ulcer on the finger, the enlarged epitrochlear gland, the spleen twice as large as normal, and small areas of necrosis in the kidneys, liver and retroperitoneal glands. There was also a massive bilateral broncho-pneumonia. Dr. Berdez will present his findings along with specimens in his discussion.

The most interesting features of these cases are:

1. That all the patients had handled rabbits.
2. That they all had the characteristic ulceroglandular syndrome in a relatively mild degree, in some cases so mild that they could have been considered a mere coincidence.
3. That they all had severe general symptoms similar to those of typhoid fever.
4. That they might be classified as a typhoid-ulcer-glandular type.
5. That two of these patients had a pustular rash and these same patients died.
6. That the leukocyte count in all of the patients was relatively low.
7. That the pulse-temperature ratio tended to be low.
8. That the temperature was high, sustained with no remissions.
9. That nothing in the way of treatment apparently changed the course of the disease.
10. That two of the patients died and the other two were ill for four and seven and a half months respectively.

Therapy up to the present is entirely symptomatic. Quinine, arsenic and salvarsen have been used but as yet nothing has proven of value.

It occurs to the writer that the logical treatment is serological, either the use of blood from a patient who has recovered or the development of a serum in some moderately resistant animal. There is a marked production of agglutinin very specific for this particular organism, and agglu-

tinin can be found in the blood of patients years after having had the disease. Ohara states that one attack seems to render the subject immune. With these facts in mind and with the rapid spread of this very serious disease, efforts to produce a protective and curative serum deserve immediate attention.

In studying the bacteriology of tularemia it also occurs to the writer that there is a striking similarity in the morphology, pathogenicity and the characteristic transmission from lower animals to man, directly or through the medium of parasites between *B. tularensis* and *B. pestis* of the plague, *B. abortus* of contagious abortion, and *B. melitensis* of Malta fever. There is cross agglutination between the latter two. We speak of the well-known typhoid-paratyphoid-colon group of bacilli. This group may well be called the tularensis-pestis-abortus-melitensis group. Possibly others will be discovered.

#### CONCLUSIONS

1. Tularemia exists in rabbits over a large area of Minnesota and contact with rabbits in the laboratory or elsewhere is a source of grave danger.

2. The possibility of such an infection should be considered in all cases having similar symptoms.

3. More attention should be paid in the future in this part of the country to the group of diseases characterized by their ready transmission from animal to man.

4. The characteristic primary lesion should not be ignored even though it is apparently insignificant in comparison with the severity of the systemic disease.

5. Some new form of treatment must be found and effort should be made to develop a specific serum or vaccine.

The writer wishes to acknowledge his indebtedness to Dr. Lloyd Rutledge, Dr. Seashore, Drs. Ekman, Bardon and Hirschboeck and Dr. Berdez for their most kind coöperation. We are all most deeply indebted to Dr. Francis of Washington, D. C.

#### DISCUSSION

DR. G. L. BERDEZ (Duluth): We are all indebted to Dr. Meriman for bringing to our attention, in the report of his early case, the clinical entity of tularemia and its incidence in man, arising from the disease in rabbits. Therefore, the autopsy case, a Finn, working on a fox farm and feeding rabbits to his foxes, might easily have escaped our attention in the circumstances

of the great rarity of the disease, had the previous discussion not stimulated our clinicians to look for it.

Up to now, only three autopsies of cases of tularemia in man have been reported, which have been performed 23 days, 24 days and about three months after the onset of the disease; in our case, the autopsy was performed seven hours after death, and about eleven days after the onset of the disease. This case is therefore of special interest for the study of the early pathology in man.

Up to August, 1926, about 300 cases of tularemia have been recorded, with eight fatalities; the death rate is somewhat below 3 per cent. In the autopsy cases, complications such as heart disease, lung involvement and others have had a bearing upon the fatal outcome of the disease, which, while quite serious and often incapacitating over several months, leads to recovery as a rule.

Our case, a man aged fifty-three years, showed at autopsy a very marked aortic stenosis; he had old pleuritic adhesions, a sclerotic focus of the left apex, a large chronic ulcer of the stomach; he showed also extensive broncho-pneumonic changes in both lungs, which, there is no doubt, were induced to some extent by the heart condition.

The changes typical of tularemia were found in the form of numerous whitish nodules in the spleen, the liver, the lungs, the mesenteric and retroperitoneal glands, and, less numerous and smaller, in the kidneys. These nodules measured up to 0.5 cm. in diameter in the spleen, the liver, and the lungs, but most of them were much smaller. They were more white and more irregular in size than the tubercles in a case of acute miliary tuberculosis, their distribution being different, their limits more clear cut.

Tubercles caused by the tubercle bacillus, which are hardly visible, require eight days to develop, under experimental conditions.

Tularemic nodules are numerous and very plain in the spleen of mice, which die usually three to four days after infection.

In our case, after a duration of eleven days, nodules up to 0.5 cm. in diameter developed; the rapidity alone of this phenomenon would have been sufficient to question very seriously the eventuality of these nodules being tuberculous.

Besides these changes, the mucosa of the fundus of the stomach showed numerous yellowish slightly raised spots measuring up to 0.5 cm. in diameter, the Payer's patches and the solitary follicles of the intestines were swollen, congested. The retroperitoneal and mesenteric glands were swollen, congested and, on cut surface, showed very plainly well delimited small white nodules. The thyroid, the pancreas, the adrenals, the musculature of the diaphragm and of the psoas showed no typical lesions. The striated musculature of the extremities has not been examined.

Unfortunately, we were not allowed to examine the bone marrow and the nervous system, in which, according to suggestions made by Francis in one of his papers, lesions are to be expected.

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eral organs, and would like to show a few typical slides to illustrate our description.

The nodules of the spleen are formed by areas of necrosis in which a few p.m.n. leukocytes and chromatin detritus can be recognized. The tissue around the nodules is quite extremely congested, the pulpa cells are often loaded with several phagocytized r.b.cs. and occasional p.m.ns. The surface of the spleen shows sometimes a thin fibrinous exudate over nodules involving the capsule of the spleen.

In the liver, there are numerous smaller and larger areas of necrosis; in the smaller areas, the contour of the liver cells can still be recognized in places, while in the larger nodules, these contours are obscured by a marked cellular infiltration. In some nodules, the infiltrating cells are mainly p.m.n., while in other nodules, mainly the larger ones, the cellular infiltration which is very dense in the peripheral parts of the nodules is made up mainly by lymphocytic cells. Where nodules involve the capsule of the liver, there is sometimes a slight depression of the surface of the liver and a thin layer of a fibrinous leukocytic exudate.

The nodules of the lung involve several alveoli, of which the contours can still be recognized by their necrotic septa; these nodules resemble very much small areas of caseation; however, a few p.m.ns., debris of exudate cells and sometimes rests of fibrinous structures can still be recognized in some of these nodules. The nodules near the pleura involve the pleura, which becomes infiltrated and avascular, sometimes necrotic. The lung tissue around the nodules shows an exudate in which numerous desquamated alveolar epithelial cells and r.b.cs. are seen.

In the kidney, besides cloudy swelling of the epithelial cells of the first tubuli contorti, perivascular infiltration is seen along small veins belonging to the system of the *venae stellatae*; this infiltration is made up mainly of lymphocytic cells.

In none of these organs (the spleen, liver, lung, kidney) could we find giant cells of the Langhans type, as they have been described in other cases of human tularemia. Small blood vessels and capillaries showed occasionally swelling and proliferation of their lining endothelium, as has been described in similar cases, and which has certainly much to do with the necrotic and progressive character of the typical lesions.

We could not demonstrate the causative organism in our sections; it has not been demonstrated in human tissues up to now; its presence in human tissues is proved by animal inoculation followed by cultures from the infected animal.

We have made a thorough search for acid-fast organisms, especially in the nodules of the lung, but did not find any. The exudate of the alveoli contained gram-positive diplococci and a few chains of streptococci, which were probably secondary invaders in an organism weakened and partly deprived of its natural defenses. These secondary invaders were not found in the white nodules, but in the areas showing the picture of broncho-pneumonia.

The thyroid, the pancreas, the musculature of the diaphragm, the stomach, the small intestine and retroperitoneal lymph nodes have been examined microscopically, and, in our sections, we failed to find changes related in a definite way to the specific tularemia infection.

The anamnesis, the clinical course, the result of the agglutination test, together with these unusual autopsy findings, were sufficient to consider the diagnosis of tularemia established on a firm basis.

It is interesting to note again, in connection with the study of this disease which recalls so much tuberculosis in its morphological manifestations, that the pathologist needs all available information to guide him in his work, because purely morphological considerations are not always sufficient to lead to final and well established conclusions.

## MONUMENTS OF NEGLECT: CROSS-EYED CHILDREN, GROWN UP

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NOT elsewhere in medicine is the proverbial expression "errors of omission" so justly applied as in the responsibility for "cross-eyed children, grown up," for in no other condition that lies within our power to benefit are there such favorable prospects for prevention and relief as there are in squint in children if properly handled during their earliest years.

That we are playing for big stakes should be firmly fixed in our minds, for squint in children brings not only grief to parents, unhappiness to the child, and humiliating self-consciousness to the youth, but also a most positive and heavy handicap to the adult, socially and vocationally.

Happily, it is no longer common experience to hear, from parents, of advice to do nothing about the matter until the child reaches twelve or thirteen years of age, and then seek surgery; but, unfortunately, we do still continue to hear of advice given them to wait until the child reaches six or seven years of age before consulting the oculist.

In view of the general, if not specific, knowledge required of graduates during the past decade and, too, the wide distribution of high-class medical literature, all of which at intervals has contained articles of modern, universally accepted thought on this subject, it is difficult to understand the rather prevailing idea that the age of six or seven years should be awaited before steps for the relief of squint be instituted, unless it is that many men harbor the thought that glasses can not safely be given to children before that age.

It is unfortunate that such an idea should be so widely held for, in fact, with the modern, well-guarded frames, children of one year of age are perfectly safe with glasses, and take most kindly and readily to them. And it is at this very early age that the most startling and almost miraculous results in relieving squint so frequently take place. At this age, indeed, it may be only a matter of weeks or even days in getting the desired result, where a few years later it

may mean many months or years and perhaps surgery in addition.

When Claude Worth, of London, one of the outstanding authorities in this branch of ophthalmology, advocated several years ago retinoscopy, refraction and correcting glasses for infants with squint, even the ophthalmological world regarded him as an unreasonable enthusiast, but time has vindicated his judgment, and today we know he was right, unqualifiedly, and that the younger the child is the better and quicker are the results obtained.

To the average person, getting the eyes straight seems to be the whole problem in hand, when in fact it is not the problem at all but only the result, which comes of itself when the necessary and essential provisions are met for its coming. These essential provisions are:

1. Preservation of visual acuity in the turning eye, which begins to be lost the moment the eye turns.
2. The development of fusion of the images from the retinae of the two eyes into one image in the brain, which results in binocular single vision; and
3. The relief of over-stimulation of convergence, a result of excessive accommodation.

The fact of the matter is that in the presence of full visual acuity and good fusion the eyes will overcome most difficult obstacles, including anatomical deformities, to align themselves properly.

It is, therefore, easily understood why the deviating eye must be rescued at the earliest age from the deterioration of disuse and also from the lapse of fusion function during the age in which its development is to take place or be irretrievably lost. Worth tells us that the fusion tendency begins rapidly to recede after the sixth year if it is not firmly established at that age, and we know that the brain soon suppresses the unfused image of the squinting eye shortly after its deviation.

Furthermore, it should be firmly borne in mind that eyes that straighten without surgery through



the help of retinoscopy, accurate refraction and proper lenses, will remain straight, while, on the other hand, eyes that are straightened by surgery, but which have neither fair acuity of vision nor fusion to hold them in fixation, are not likely to remain straight, regardless of how accurately the surgical correction has been done.

In the greater portion of squint cases in children, crossed eyes, or convergent squint, is the deformity with which we have to deal, and this is almost wholly the result of a discrepancy or inequality in the required accommodation (or focusing effort) and the convergence. An infant's eye is a short (far-sighted) eye, requiring much accommodation effort to focus on near objects, and the accommodation effort relatively is far in excess of the associated convergence needed in later years, a relation which is constant and uniform and almost impossible of disassociation, as companion functions, in mature eyes. The excessive accommodation leads to over-convergence in the infant before the fusion function is sufficiently developed to check it by firm binocular fixation, and the squint develops as a result.

To begin with, let us consider the behavior of but one eye alone, singly and independent of its mate. Visual fixation upon an object is necessary to hold an eye in any given position, and requires at least fair acuity of vision in the eye for its accomplishment. If fair acuity of vision can be raised to a high degree of acuity in the eye by the proper lens, the fixation will be further strengthened and more dependable.

If, then, both eyes be given full acuity of vision and become capable of firm and dependable fixation, and, in addition, the fusion faculty is also present to fuse the images of the two eyes into one image in the brain, binocular single vision with perfect alignment of the eyes will result, and will remain so if the over-stimulation of convergence is checked through the relief of excessive accommodation effort.

To the laity and, in fact, to almost everyone not familiar with the accuracy of retinoscopy, the determination of lenses of proper strength to suit the refractive needs of a little child would seem an uncertain task. It is, however, not at all uncertain, for most infants will fix their gaze upon a light even longer than older children, and the neutralization of shadows by lenses of known

strength quickly gives the operator the necessary information to correct the refractive errors present after cycloplegic relaxation with atropin.

The skilled optician, filling the prescription, completes the requirements with safe and appropriate spectacles, which practically are always accepted and well borne by the child. Occasionally a silk tape attached to the temple pieces must be used and tied behind the child's head, but in my experience has seldom been required. The result in many cases is startling and almost unbelievable, to the joy of all concerned.

It is not an infrequent occurrence to have the eyes straighten in a week or two or even in a few days, which means that you have won, and that all that will be necessary will be to secure time for the firm development of fusion during the formative period of the child's life.

Of course, a careful examination of the baby's eyes must be made to exclude congenital malformations and defects that would preclude possibilities of normal visual functions. Congenital cataract, optic nerve and retinal defects, as well as prenatal intra-bulbar disease, are to be watched for in determining the prognosis of any case.

The fusion faculty, it should be clearly kept in mind, is purely a psychic process, and even though (quoting Worth) "the images formed in the two eyes differ in shape, size or position, if the disparity be not too great, the oculomotor apparatus will place the eyes in the most favorable relative positions; and the fusion sense, by virtue of its elasticity, then fills the gap which may remain."

Experiments with the stereoscope show this to be true, and Verhoff's experiments, especially, show how the fusion sense is capable of blending divergent oblique lines into the vertical, omitting any influence upon portions of his test objects which are seen only by one eye. Worth, by his amblyoscope, shows also where, by suggestion, the psychic function of fusion can move altogether different objects into the same field; whereas, before such suggestion they remained separate and apart in different fields in the stereoscope.

Up to comparatively recent times eyes out of line (squint) were considered to be entirely so as a result of unequal length or strength of the extrinsic eye muscles, or as a result of anatomical irregularities. While there are still occasional

theories along this line of thought put forward, and such conditions do add to the difficulty later, the generally accepted causes of squint are those enumerated above, and the efforts of ophthalmologists working along this line have been rewarded as never before.

Full consideration of the subject of squint, or strabismus, in its entirety is far beyond the attempt of this paper, and only the usual concomitant squint met with in children is meant to be included.

Paralytic squint, as a result of birth injuries, subsequent trauma, intracranial or orbital tumors, constitutional disease, the toxins of infectious diseases and focal infections, while constantly to be kept in mind in connection with this subject, is entirely outside the application of procedures discussed here.

Surgery, too, has its very important place in squint, and should be promptly resorted to when it is unmistakably evident that the fusion sense present or developing is not capable of bridging the gap. In such cases, after the eyes are closely aligned by surgery, frequently a weak fusion sense begins to take up its function. Modified tenotomies and muscle tucking have, further,

gone far to eliminate the uncertainties and risk of over-correction.

But, regardless of what form or kind or condition of squint is to be dealt with, a careful ophthalmological examination, with accurate refraction by retinoscopy under cycloplegic, should be the first and foundation work upon which to determine our entire handling of the case.

If every practicing physician and graduate nurse would feel his individual responsibility in directing and advising, insistently, the parents of "cross-eyed" infants to seek immediate relief at the hands of competent ophthalmologists, the economic fortune to humanity would be incalculable, not to mention the happiness of parents and grown-up subjects. And who knows but that we may have a possible future Oliver Cromwell or Florence Nightingale standing before us, whose fate may be in our hands, and at the parting of the ways, and approaching the fork in the road of life, either to develop into a leader of his fellows or to be stunted by the development of an inferiority complex within him?

The reward of diligence is too great and the price of effort too small in this matter for us to miss endeavoring to relieve a single case of squint that comes before us.

#### PERUNA—ANCIENT AND MODERN

The Eighteenth Amendment gave a great stimulus to one branch of the "patent medicine" industry—that devoted to the exploitation of alcoholics sold under the guise of home remedies. Originally containing about 27 per cent of alcohol and very little else, the use of Peruna as a beverage in those parts of the country that were at that time nominally "dry" was notorious. Cases of acute and chronic alcoholism, and even, in some cases, of death from its use are matters of record. In 1905 the sale of Peruna to Indians was prohibited. In the same year the Bureau of Internal Revenue classed Peruna as an alcoholic compound advertised and sold as a medicine, but without the addition of drug in sufficient quantity to change materially the character of the alcoholic liquor. Then the formula of Peruna was changed and sufficient senna added to satisfy the Internal Revenue Department that Peruna could no longer be used for beverage purposes. At that

time the alcohol content was cut down from 27 per cent to 20 per cent. When national prohibition was enacted, the alcohol content of Peruna was further reduced to 12 per cent. Now, within the past few months, another change has taken place. The manufacturers have added 6 per cent alcohol and have taken out the senna! They have also taken out golden seal, which for some years has been one of the alleged ingredients; on the other hand they have added wild cherry, gentian and potassium iodide. The theory under which alcoholic "patent medicines" are supposed to be tolerated by the Internal Revenue Departments is that they shall contain the minimal amount of alcohol possible. Just why the manufacturers of a nostrum with a history behind it such as Peruna should have been permitted to increase the alcohol content of their preparation 33 per cent is another of those mysteries that only government bureaus can explain. (Jour. A. M. A., October 22, 1927, p. 1444.)

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## VALUE OF REFRACTION IN CHILDREN\*

W. H. FINK, M.S., M.D.

Minneapolis

THE object of this paper is to emphasize the necessity for the early care of eyes of children. With the increasing work of the school clinics the eyes of children of school age are usually watched; but no thought is given to the fact that children of the pre-school age may also have serious defects of vision. This is more important from the fact that it is during these earliest years of life that the best permanent results may be secured. Only too frequently have I been called upon to treat eye defects that are beyond repair and which could have been easily restored to normal if seen and cared for in early life. It has also been found that many other conditions not ordinarily associated with eye defects may really be due to visual errors. This fact is well illustrated in several cases in the series I am reporting.

To bring the matter to a more definite basis 100 consecutive cases have been selected whose ages range from nine months to seven years. Of this group fifty-six had a slight or moderate error of refraction and the remaining forty-four had a high degree of error.

The refractive conditions making up the second group were of such a character that if they were not cared for early in life permanent damage would result. For this reason it is this group that I wish to particularly emphasize. These cases may be subdivided for the sake of simplicity into the following:

1. Hyperopia with or without astigmatism.
2. Myopia with or without astigmatism.
3. Astigmatism.
4. Anisometropia.
5. Opacities of the media.

Hyperopia is the most frequent error and there were 21 cases of this condition or approximately 47 per cent of all cases in this group. High degrees of hyperopia are hereditary and are practically always present at birth. A condition of this type demands early attention if the visual acuity is to develop normally. To allow the error to go uncorrected during the period of de-

velopment of the visual acuity will result in an eye which does not have normal vision. This means that in adult life the eye can never be corrected to full vision. No matter though the error be corrected by glasses the person will never be able to read the 20/20 line. Since the period of development of visual acuity is from birth to the sixth year, early correction is desirable. If necessary, glasses may be worn by babies as young as nine months.

As has been stated, early correction may prevent the development of or give relief from other conditions, some directly related to the eyes and others not suggestive of them. Some of the various conditions noted are nervous irritability, epileptiform convulsions, melancholia, neurasthenia, tachycardia, night terrors, indigestion, constipation, dizziness, chronic lid irritation, lateral curvature of the spine, pain in the nape of the neck and other portions of the body.

Four of the cases were mongolian idiots and these were greatly improved in their mental reaction. Two were albinos with marked errors. They were markedly benefited by correction of their error of refraction and use of tinted lenses.

Convergent strabismus is a frequent complication of high hyperopic error and was present in twelve of the twenty-one cases. This condition usually appears at the age of three but the onset may be before the first year. It is due to the excessive effort of accommodation which is made to overcome the hyperopia. It is very important that convergent strabismus receive early care because the vision of the squinting eye does not develop. This is because of a relative disuse and if not corrected before the sixth year a permanent loss of vision results, the eye becoming practically useless. The result is a patient who is cross-eyed and who has but one useful eye. Even if operated he does not have binocular vision or depth of perception and is usually backward and sensitive. By early care all of this may be avoided. Simple correction with proper glasses will cause the eyes to be parallel, normal binocular vision, normal mental development and the avoidance of an operation.

\*Read before the annual meeting of the Minnesota State Medical Association, Duluth, Minnesota, June 30 to July 2, 1927.

Myopia is the second most frequent error and was present in eight cases. An hereditary factor plays an important rôle, although this condition is seldom seen at birth. The onset is usually in the early years of life. Its rate of development depends to a great extent upon whether the eyes are used excessively for close work and whether or not they are relieved of strain by proper correction. Any child who has a family history of myopia should have its eyes examined. If any myopic tendency is present, close work should be limited and the refractive error corrected. Under this regime the progress of the myopia is frequently checked, the eye develops normal visual acuity, the ciliary muscle develops normally, a divergent squint often is prevented and mental development is normal. If neglected, fundus changes are not uncommon and the sight in the eye may eventually be lost.

Astigmatism alone was present in five cases. This condition is usually present at birth and may progress if not corrected early. In high degrees, early care is essential, as it will at least prevent an increase in amount and will allow the eye to develop normal vision; squint will not develop, symptoms of eye strain will be eliminated and the child will develop normally mentally.

Anisometropia was found in three cases where one eye was hyperopic and the other myopic. If not corrected early, one eye is neglected and does not develop, leaving the patient with but one useful eye. If corrected, both eyes develop normally.

Opacity of the media was present in seven of the cases on this series. Three of these were cataracts, two being traumatic and one congenital. If the condition does not involve the entire lens an attempt should be made to bring the

vision up with glasses. If not successful an operative procedure should be employed and a glass given to bring out the vision. This will give the eye an opportunity to develop normal visual acuity which it cannot do if the cataract is allowed to go uncared for.

There were four cases of corneal opacities which were classified as interstitial keratitis, trachoma, old ulcer and traumatic. The vision in this type of eye is usually poor but it can be greatly improved and the development of the eye aided.

While not including all conditions which may be encountered, the cases listed give some idea as to the frequency and types of conditions found in young children. The age of the child is no excuse for neglecting the eyes. An accurate examination can be made on a child of any age. If too young to cooperate, the glass is ordered from the retinoscopic reading taken under ether anesthesia. Atropine is absolutely essential in the examination of all children because without it the eye is not relaxed and it is impossible to bring out the true error. If one child in a family shows a refractive error, the remainder of the children should be examined, as not infrequently the same type of error is present in all members.

In closing I wish to urge more frequent refraction in young children. Too frequently symptoms of eye strain are looked upon as indications of some other conditions and treatment given accordingly. If no trouble is found the examination has at least done no harm and the eyes have been eliminated as a cause of the trouble. Early care of refractive errors is the greatest step towards the conservation of vision. Attention to this important procedure will enable many children to grow into normal adult life who, in the past, have been allowed to struggle along as best they might.

#### ARC EPILEPSY REMEDY

The medical profession has recently been widely circularized by the American Remedies Company of Rockford, Ill. The medical profession is asked to use the firm's "Reliable Remedy for Epilepsy" and is told by the firm that it does not "feel justified" in exposing its formula—that is, the medical profession is asked to prescribe a preparation of secret composition. The A. M. A. Chemical Laboratory analyzed the ARC Epilepsy Remedy and found it to consist of capsules, each

containing about 1½ grains of phenobarbital (luminal) and a considerable amount of a laxative (emodin-bearing) drug and a small amount of dye. Is it possible that there are physicians who are so gullible and forgetful of their duty to their patients that they will give a dangerous drug in unknown dosage? A physician who uses or prescribes "ARC Epilepsy Remedy," giving so dangerous a drug as phenobarbital in unknown dosage, may lay himself open to a charge of doubtful practice. (Jour. A. M. A., October 1, 1927 p. 1167.)

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## DIAGNOSIS AND TREATMENT OF NON-OPAQUE FOREIGN BODIES IN THE AIR PASSAGES\*

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*Minneapolis*

A NON-OPAQUE foreign body may be defined as one that does not cast a shadow on an *x*-ray film. I have included small bones in this group because they may or may not cast a shadow, depending upon where they are lodged. In the air passages, they cast no shadow, but they may in the esophagus.<sup>1</sup>

Non-opaque foreign bodies are met in the air passages with greater frequency than opaque ones; in fact, seventy per cent are non-opaque. This is not true in the esophagus in that forty-five per cent of the foreign bodies lodged there are non-opaque as against fifty-five per cent of the opaque variety. These facts are easily understood when we stop to think that the smaller foreign bodies pass readily through the esophagus because of its size, whereas the larger ones are more likely to become lodged there; the small foreign body is usually some article of food, whereas the larger one is more often an object such as a coin, a safety pin or a large bone.

Foreign bodies find their way into the air passages of infants and children much more frequently than into those of adults. This is probably due to the child's lack of proper coördination during the complex action of swallowing, the larynx not being closed at the proper time. Also, the larynx is much higher in children and infants than it is in adults. Carelessness of the mother or nurse in not watching everything that goes into the mouth of the baby is a prolific cause of foreign bodies being aspirated. Ninety per cent of non-opaque foreign bodies are found in children under two years of age. The younger the infant, the more severe is the reaction likely to be.

The foreign body found most frequently in the air passages of children is the nut, such as peanut, Brazil nut, coconut and almond, whereas seeds are a close second, among which may be mentioned the seeds of the watermelon and, also, peas, beans, corn and cherry pits, if they may be properly classified as seeds. It is obvious that

such a condition could be easily avoided in the case of infants of two years of age and younger because nuts, seeds and such things are not proper articles of diet for infants. Yet, it is surprising how many cases there are of infants choking on some of these things that have been fed to them by injudicious parents. One of my patients, a baby only one year of age, had a piece of nut lodged in his bronchus by a parent—whether mother or father—feeding him *chow mein*.

Much care must be taken by the medical man in obtaining a comprehensive and accurate history in cases such as these. When a mother reports that her infant has met with such an accident, she is very frequently correct in her diagnosis of the case. It is natural for many medical men to attempt to allay the fears of the anxious mother by assuring her that there is nothing the matter with the baby, but the physician should take pains to make no such assurance until he has made a complete and thorough examination which should be supplemented with the *x*-ray. Deductive conclusions are dangerous. On the other hand, it takes a first class and thoroughly experienced clinician to diagnose a foreign body when the history is negative. Pneumonia or laryngeal diphtheria are more likely to be thought of first before considering a foreign body as a possibility. As an illustration of the truth of this statement, I will cite the instance of one of my patients to whom was administered 60,000 units of diphtheria antitoxin by four different physicians before a diagnosis of foreign body was made.

Clinical features brought about by non-opaque foreign bodies in the air passages are very much more striking and are quite different from those caused by opaque foreign bodies. The outstanding feature is the violence of the reaction. This reaction is not caused by the peanut alone, as was formerly thought, but it, being the most common, is usually considered the most dangerous. Any organic foreign body may produce as violent a reaction as the peanut. I am borne out in this

\*Read before the annual meeting of the Minnesota State Medical Association, Duluth, Minn., June 30 to July 2, 1927.

by a number of standard authorities.<sup>2, 3, 4</sup> One of them bases his opinion upon an analysis of 505 cases.

Vegetable organic foreign bodies may produce immediately a violent tracheo-bronchitis, both proximal and distal to the foreign body, in which trauma, edema, congestion, exudation (membranous at times), and spasm all play a part. The child is toxic with a high fever and a violent cough. Such a reaction as this comes as a result of the presence of a non-opaque foreign body, whereas one would not meet it very often in cases where the intruder is opaque, such as a nail, a safety pin or other metallic object. When an opaque foreign body is removed, the patient usually is relieved immediately, but this is not true in cases of the non-opaque body, as the reaction is usually so violent that a reasonable length of time must elapse before it subsides and the patient gets relief. In fact, the post-bronchoscopic care of the patient is often as important as the bronchoscopy itself. Eight of my thirty-one cases of non-opaque foreign bodies required intubation after the removal of the objects and a tracheotomy was necessary in two others. Neither intubation nor tracheotomy was found necessary in any of my metallic or opaque foreign body cases.

The first symptoms of foreign body in the air passages are choking, gagging, coughing, wheezing, cyanosis, vomiting, prostration and dyspnea and in rare instances death ensues immediately. When an infant chokes, is cyanotic and wheezes persistently, a bronchoscopy is imperative, regardless of other symptoms or findings.

As the foreign body passes down the air passage, other symptoms make their appearance with reference to the location of the foreign object. If it is in the larynx, hoarseness, croupy cough, aphonia or dyspnea with substernal retraction may be present and a laryngoscopy should be performed to make the diagnosis. A laryngoscopy will rule out trauma from digital or instrumental efforts at removal of a foreign body and it will also rule out whooping cough, croup, laryngeal diphtheria, laryngitis, laryngismus stridulus, thyroid or thymus enlargement, papillomata, congenital stridor, laryngospasm from spasmophilia, overflow from obstruction of the esophagus from a congenital atresia or foreign body, or esophagotracheal fistula.

Should the foreign body be lodged in the trachea, the patient may have sudden cyanosis and coughing when the foreign body bounces against the vocal cords. When it finds its way into a bronchus, there is a period of quiescence which may be quite confusing to the medical attendant. As the object moves around and is forced suddenly against the vocal cords, there is heard distinctly a slapping noise which is quite pathognomonic of a tracheal foreign body. This same noise is accompanied by a thud that may be distinctly palpated. As Jackson<sup>5</sup> has it, "the audible slap and palpatory thud."

When the foreign body lodges in one bronchus, breathing may be quiet and regular through the unobstructed bronchus. Wheezing is a very ordinary and common symptom of bronchial foreign body; at times the mother is able to feel the wheeze with her hand and to locate the side upon which the obstruction lies.

"In many cases, there is a peculiar variety of restlessness accompanied by a facial expression of anxiety. The baby would seem to be sleepy, but he does not dare to close his eyes for fear his breathing will cease. It is only necessary to glance at a child in such a condition to realize that it is very seriously ill."<sup>6</sup> In other children, there may be an obstruction to a part of the lung, where there is no dyspnea, except on exertion, and apparently there is nothing wrong. As Manges says: "There is no other condition so grave and serious as this where the symptoms may appear to be so slight or to vary to such a degree."

Physical signs are not necessarily constant, as they vary materially at different times depending upon the shifting and changes in location of the foreign body and of the secretions resulting from its presence. The most constant and valuable signs are: (1) bronchial obstruction, as shown by diminished intensity of the breath sounds distal to the foreign body; (2) impaired expansion on the obstructed side, which sign can be noticed when the intruder is of very minute proportions, in which case it is the most valuable of all of the physical findings; (3) fremitus is palpable at times when no other indications are plainly marked. There are other signs that are not of so much value, as, for instance, those obtained by percussion, which depend upon the degree of obstruction in the bronchus. If the obstruction is complete, there will be found one of two

things: either a collapsed lung which will produce tympany for a time or a drowned lung which will occasion diminished breath sounds and absent fremitus and may lead to a diagnosis of empyema. On the other hand, a partial obstruction will bring about an emphysematous lung with varying degrees of tympany. Those signs obtained by auscultation are perhaps of more value than those secured by percussion, although râles

ness, the fact that there is no shifting dullness, and the greater resistance, which is present in empyema, nearly always clears up any difficulty promptly. The absence of the frequent change in the voice sounds, so significant in an early small empyema, is of value. A large empyema should give no difficulty. If difficulty remains, the use of the needle should be sufficient. In thickened pleura, vocal fremitus is not entirely

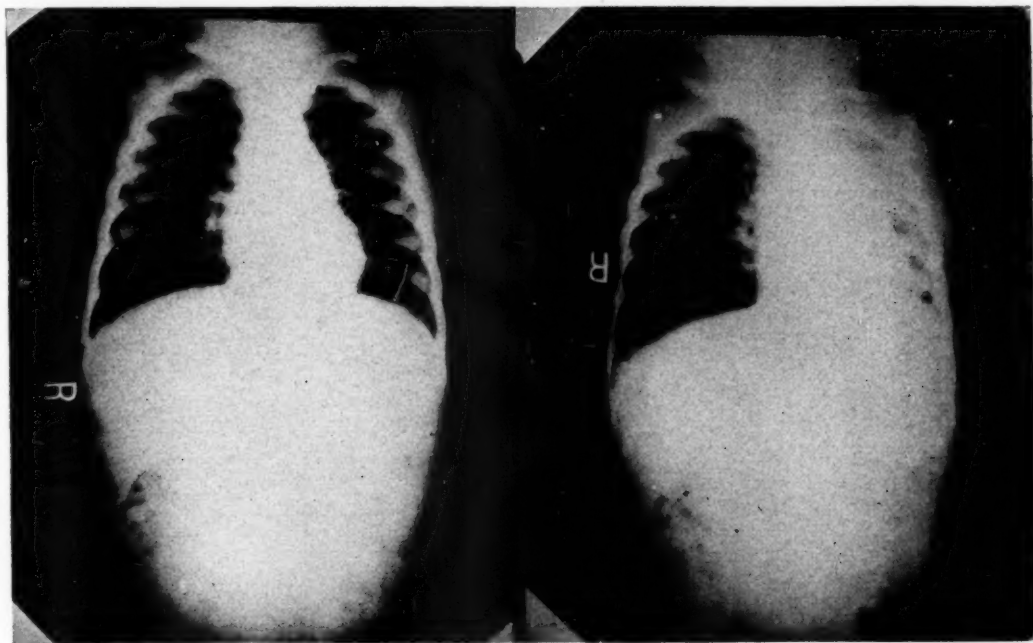


Fig. 1.

Fig. 2.

Two films taken of a child fifteen months old, who gave a history of choking on a piece of bacon at breakfast (5 hours before the films were made). The mother found a small piece of walnut in the child's mouth at the time of the accident.

Fig. 1. Inspiration: note the slightly better penetration on the right side.

Fig. 2. Expiration: The right side shows much greater penetration than the left. The mediastinal structures and heart are displaced to the left and the right diaphragm is depressed.

Diagnosis: Obstructive emphysema, right, due to a non-opaque foreign body in the right bronchus.

Bronchoscopy: A large piece of walnut removed from the right main bronchus.

are not always heard on the obstructed side when the obstruction is complete, as they may show up on the side that is free from trouble; but when the obstruction is partial, râles are usually found distal to the foreign body.

Professor McCrae, who sees all of Jackson's cases and has therefore had a tremendous experience writes: "There is no one description of physical signs which covers all cases. If the student will remember that complete obstruction of a bronchus leads to a shutting off of this area, there should be little difficulty in understanding the signs present. The diagnosis of empyema may be made, but the outline of the area of dull-

ness and the breath sounds can usually be heard, even if diminished. In case of partial obstruction of a bronchus, it is evident that air will still be present, hence the dullness may be only slight. The presence of air and secretion will probably result in the breath sounds being somewhat harsh and will cause a great variety of râles, principally coarse, and many of them bubbling. Difficulty may be caused by signs in the other lung or in a lobe other than the one affected by the foreign body. If it is remembered that these signs are likely to be only on auscultation and to consist largely in the presence of râles, while the signs in the area supplied by the affected bron-

chus will include them on inspection, palpation and percussion, there should be little difficulty."

The *x*-ray is without doubt our most potent and valuable aid in diagnosis. Although it never does show the non-opaque foreign body, nevertheless it demonstrates the different aëration of the lungs. Manges<sup>6</sup> has perfected this technic to a remarkable degree and his results are now being duplicated throughout the entire habitable globe. The *x*-ray findings depend absolutely upon the type of bronchial obstruction, which may fall in any one of three categories: (1) the bypass valve type, where air passes both in and out; (2) the check valve, in which case air can pass in but cannot be expelled; (3) the stop valve, which prevents air from passing in either direction. The most frequent finding is of the second type where air can go in, but not out, which produces a condition of obstructive emphysema. The *x*-ray evidences of obstructive emphysema are: (1) increased transparency of the affected lung, which is most in evidence at the end of expiration (but it takes a very skillful operator to get a film at the particular instant that the lung is empty of air although it may show up at other times as well); (2) depression and limitation of motion of the diaphragm on the affected side; (3) displacement of the heart and mediastinal structures to the unaffected side at the time of expiration. The displacement of the mediastinal structures is easily observed through the agency of the fluoroscope and to see the heart and other structures move from side to side during respiration is a sight not soon to be forgotten. As I have said, the stop valve is a complete obstruction and results in atelectasis, sometimes called collapse. Under such circumstances, the air is absorbed and the lung shrinks, becoming a solid mass which casts a dense shadow on the *x*-ray plate. The heart becomes displaced toward the affected side, the amount of displacement varying with the size of the lung. In the case of a collapsed lung the air spaces in it may eventually become filled with exudate or pus, in which event the lung may become expanded to its normal size, at the same time being entirely devoid of air. This condition is known as drowned lung. If the infection continues long enough, the drowned lung may develop into a lung abscess.

Manges<sup>6</sup> is of the opinion that small non-opaque foreign bodies are the proximate cause of

many lung abscesses. He says: "When there is evidence of an infectious pneumonitis in the distribution of the lower lobes of the bronchi, the inference should be that the lesion is due to aspiration of some foreign material unless there is a very definite history of another cause. In the first place, this is the location where foreign bodies go when they are small enough to get there. In the second place, we know that a chronic infectious pneumonitis or chronic lung abscess is the rule in foreign bodies of long sojourn."

In the case of non-opaque foreign bodies in the trachea, the *x*-ray signs are: (1) increased transparency of both lungs; (2) depression and limited motion of both diaphragms; (3) rotation of the heart in such a way that its transverse diameter is less at expiration than it is at inspiration, which can be determined by measurement if necessary.

There are cases in which these signs are found in combination, as atelectasis and obstructive emphysema in the same lung, in which event the interpretation may be rather difficult, although the diagnosis of a foreign body is usually established.

There are cases when the *x*-ray will localize a foreign body in a particular place, but at the time of operation it may have been dislodged so that it is removed from a different location from that demonstrated by the *x*-ray. This should not be considered an inaccuracy on the part of the *x*-ray, as the probabilities are that it has been disturbed by the insertion of the bronchoscope.

These *x*-ray findings are usually the result of a narrowing of the lumen of the bronchus, but this condition does not always depend upon the presence of a foreign body. There are a number of things that may produce this condition and must be ruled out of the diagnosis of a foreign body, such as: (1) new growths—for example, a polyp of the bronchial mucosa<sup>7</sup>; (2) tuberculous granulation tissue<sup>8</sup>; (3) bronchial diphtheria; (4) mucous plugs as in massive collapse of the lung<sup>9</sup>; (5) compression stenosis of the bronchus as peribronchial glands, aneurysm or mediastinal tumor.

I have had two cases where obstructive emphysema was demonstrated on the *x*-ray film in neither of which was I able to locate a foreign body. In my opinion, the foreign body was there at a recent time, but it was doubtless coughed up



before bronchoscopy. I am sure that the foreign body was not present because both of these children are alive and well at this writing.

The invariable treatment of these cases is bronchoscopic. The removal through the medium of the bronchoscope, while often difficult, can safely be done in the majority of cases by the experienced operator. One might be tempted to let nature do its work, but statistics have demonstrated that under such circumstances the foreign body is coughed up by only two patients out of a hundred, and the other ninety-eight will inevitably develop some serious lung condition that will result in death.

In conclusion I wish to emphasize the fact that:

1. Ninety per cent of the non-opaque foreign body cases occur in children under two years of age.

2. It is usually possible to obtain the history and it is of enormous value.

3. The reaction caused by the foreign body, rather than the foreign body proper, is responsible for most of the symptoms.

4. X-ray is exactly as valuable in the diagnosis and localization of non-opaque foreign bodies as it is of the opaque variety.

5. Bronchoscopic treatment, or removal, is the only treatment advisable.

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## HEART DISEASE FROM THE INSURANCE STANDPOINT\*

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TO CONSIDER this subject fully, one should include all types and manifestations of disorders of the heart and circulation. However, I shall have to confine my remarks principally to the "significance of heart murmurs" and shall refer to these abnormalities as impairments rather than as "diseases of the heart." No attempt will be made to touch upon the various irregularities of the pulse, such as extra systoles, sinus arrhythmia, etc.

Heart murmurs reported in routine insurance examinations have caused great uncertainty and misapprehension as to their bearing upon the insurance risk. They have ranked high among impairments as a reason for rejection, and it was common practice among insurance companies prior to twenty years ago to decline all risks evidencing a heart murmur of any sort. This was because of the belief, now antiquated, that murmurs are always indicative of heart disease.

Because murmurs were heard in valvular heart disease, it was accepted as a fact in insurance medicine that murmurs meant heart disease. Whatever value we at the home office may place upon a reported heart murmur, we must first decide—"Is the murmur functional or is it organic?" and, second, "What effect is it likely to have on the applicant's longevity?" It is a fact borne out by clinical and life insurance experience that some of those suffering from so-called heart disease will succumb to some form of heart disease only too soon, and that others will live out their span of life with normal vigor.

Since the fundamental idea of life insurance is protection of those who would otherwise be dependent, it is the purpose of life insurance companies to desire to issue insurance to everyone to whom it may safely be granted. Unquestionably, in the past, many applicants for insurance have been denied the benefits which life insurance affords, owing to the fact that some examiner in the field has reported a slight mitral murmur heard at the apex, without any other symptoms or signs of heart disturbance; and

some of these have continued to live to a ripe old age in spite of the heart murmur. Many similar cases would now be granted some form of protection.

At present, the interpretation of heart murmurs is so confusing as to bewilder not only the clinician and examiner, but, even more so, the medical director who must interpret the examiner's findings and value the risk for insurance in large amounts. I wish to emphasize this statement by citing quotations taken from the literature wherein recognized authorities on heart disease have expressed their opinions.

Sir James McKenzie: "Murmurs may appear in hearts with no damage to the valves. Individuals with functional murmurs may be in perfect health and lead strenuous lives and never show the slightest sign of heart failure. From this we can conclude that murmurs may be physiological and normal even and indicate neither impairment of the heart's efficiency nor foreshadow the oncoming of heart failure."

And further: "Consideration of the functional efficiency of the heart offers, undoubtedly, the best guide in these cases, and we may fairly assume that when the heart is normal in size and its efficiency is not impaired, the murmur is physiological."

Lewis Connor: "I am inclined to believe that one will make the fewest mistakes in the diagnosis of mitral regurgitation by adhering to the rule of never venturing a diagnosis on the presence of a murmur alone, no matter how characteristic it may seem to be, and further, it is believed that full nine-tenths of all apical systolic murmurs belong to the class of accidental or functional murmurs."

Paul White, in a recent monograph, states: "Slight apical systolic murmurs (not transmitted from the base) are common and of themselves of little or no importance, in the absence of other signs of heart trouble. Their mechanism is often obscure."

Dr. G. Buller: "It is safe to say that a primary mitral insufficiency should, in no case, be diagnosed unless in addition to the murmur there is evidence of hypertrophy and preferably a definite history of rheumatism."

Hirschfelder says: "Murmurs of the heart without the presence of valvular lesions are so common that autopsy evidence led Laennec to the erroneous belief that murmurs were of no diagnostic importance whatever," and refers to the fact that "Potian, who has made the most extensive investigations upon the subject, found such murmurs in one-eighth of all the patients seen in his hospital service."

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Turning now to organic murmurs, Norris says that the French have an axiom, "A disease of the valves is not a disease of the heart," and quotes Sir Andrew Clark to the effect that in the study of 700 cases he found there was often practically no shortening of life and MacKenzie wonders "whether the use of auscultation has not been the means of doing more harm than good." Martin says, "To regard the mere existence of say a mitral murmur, even with a previous rheumatic history, as, per se, a grave omen or a cause of rejection for life insurance seems to blind oneself to the more accurate knowledge acquired from recent investigations."

Cabot says: "Not every murmur which is to be heard over the heart points to disease either in the valves or in the orifices of the heart. Perhaps the majority of all murmurs are thus unassociated with valvular disease."

In his latest book, "Facts on the Heart," Dr. Cabot starts out his first chapter with this bold statement: "The first, and in some ways the most important part of all, is to know that most heart disease is imaginary." "Mitral regurgitation without stenosis was apparently present in seven out of 1,906 necropsies of this series. Three of them were doubtful. It is obviously, therefore, one of the rarest lesions discoverable at post-mortem. During life there are no signs by which it can be recognized. It is not a clinical entity."

"Over 90 per cent of all cases of genuine heart disease fall under one of the three types here called rheumatic, syphilitic, and hypertensive. Most diagnoses of heart disease, whether made by physicians or suspected by the patient, are in my experience wrong. In such cases the heart is usually sound."

"Mitral regurgitation is one of the rarest of valvular lesions and cannot, with any certainty, be recognized in life."

The literature reviewed shows such a marked divergence of opinion that we may be pardoned for some unwillingness to be guided in our selection by the opinions even of such noted investigators as above referred to. We cannot, for very good reasons, immediately adopt each new idea and so-called "advance in medicine," but must be so conservative as to appear unprogressive; new theories developed and exploited even at the hands of noted investigators must be carefully weighed, and considerable time must elapse before sufficient experience is acquired to justify us in adopting these measures.

Clinical and post-mortem observations offer us but little help in evaluating the effect of these murmurs on longevity. As a matter of fact, they really tend to minimize their significance, although from our life insurance experience we know full well that these murmurs must not be disregarded. The authorities quoted give us no

dependable idea of the nature of the heart disease, if any, which is the underlying cause. Therefore, to discover the effect, we are obliged to fall back upon our own resources gained by experience in this class of cases.

Previous to 1925, the method commonly used in classification of murmurs was based upon the generally accepted diagnosis of an impairment or combination of impairments rather than upon the reporting of the actual physical signs. Formerly, heart murmurs were reported as regurgitation through, or obstruction of, mitral, aortic, bicuspid, and pulmonic valves, as functional murmurs or as plain heart murmurs, without details. Such a classification allowed full play of the personal equation of the differing individual opinions of examiners and medical directors. Beginning with 1925, a classification has been in use which stresses the reporting of physical signs, and it is hoped that by this method a more detailed analysis and comparison of experience may be gained.

Insurance medicine is endeavoring to keep pace with modern medical thought and is willing that clinical medicine point the way. An insurance company is necessarily handicapped by not being able always to secure the services of experts in the field to examine their applicants, nor to avail themselves of the finer instruments of precision such as the x-ray, electrocardiogram, etc., for a more intensive examination of the heart conditions of their applicants. Were this not so, it might be possible to make decided changes in our ratings and perhaps to enjoy a better mortality in our heart cases than is now possible. Insurance has to do with the coverage of *average* lives, and, for obvious and practical purposes, these must be examined by physicians of average ability or better. The results obtained are influenced by the interpretation of their findings.

Emerging from this haze of present day "cardiological fog," it may readily be seen that the companies must place a great burden upon their examiners in the field in expecting them to interpret and diagnose properly that type of heart murmur found near the apex; which is localized rather than transmitted; which is constant and exists as a solitary circulatory impairment—the mitral regurgitant murmur. Since there is no unanimity of opinion as to its significance among

life insurance medical directors and apparently the same problem confronts the internist, there are some who will classify all systolic apical murmurs as indicating mitral regurgitation; others will do so only in the presence of apparent hypertrophy, of an accentuated pulmonic second sound, or a murmur so harsh that it is widely transmitted.

The difficulties attending the interpretation of true cardiac conditions are always great, particularly in life insurance, where one or two examinations of an applicant must suffice. The average physician may be an excellent examiner and a man of good judgment, but it is absurd to say that he can elicit or express in definite terms the finer shades of diagnostic signs that enter so greatly into the prognosis of these cases.

With this in mind, companies doing substandard business especially, have devised various types of heart blanks upon which the examiner is expected to report his findings in writing and graphically upon an outline of the chest.

The special heart blank tends to put the examiner on his mettle, and at the same time enables the company to make a fairly accurate estimate of the value of his work. By following the instructions contained in the blank, he will develop information otherwise overlooked in the course of the usual casual examination. It often happens that the company finds it necessary to request a reexamination of an applicant, on account of a history of some heart impairment or owing to unfavorable information on file at the home office. This request is often resented by the examiner and wrongly considered as an affront or to indicate a lack of confidence on the part of the company. This should not be so, as often murmurs and other impairments, at first overlooked, are elicited in the course of a special heart examination after exercise or by examination in a reclining posture. Many of our tried examiners in the field use this blank automatically in reporting their heart findings in every suspected case, thus obviating delay in disposing of the case and also obviating the necessity of seeing the applicant a second time. The extent of confidence in the examiner plays a large part in ultimately placing the proper value on the risk.

There are several important factors which enter into the consideration of this subject: (a) If a heart murmur is present, what is its nature? (b) the degree of enlargement, if any; (c) the

rate and character of the pulse; (d) the blood pressure, both before and after exercise; and having through these factors determined the nature of each case, it is the medical director's duty to determine what mortality is to be expected in a group made up of exactly similar lives, compared with an equal sized group of normal lives.

Routine use, in every insurance examination, of the exercise test and heart blank would be most valuable to insurance companies, but there are many reasons, competitive and otherwise, which make its routine use impracticable. It is,

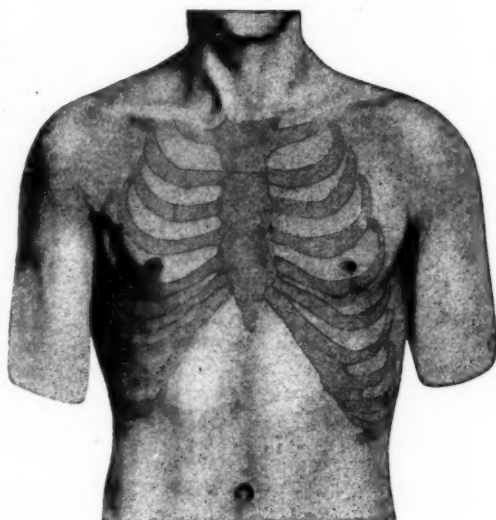


Fig. 1. Heart chart.

however, a valuable adjunct, easily utilized when occasion warrants. It is easily employed and understood and does not require special training to carry out. It also causes no inconvenience to the applicant. It is our experience that many of our examiners use it routinely where there is any suggestion of cardiac impairment or irregularity.

Some five years ago Dr. Harold M. Frost of the New England Mutual Life Insurance Company, in an effort to find some way to separate the good cases showing heart impairments from the bad, developed what is known as a cardio-respiratory test. This test applies to the cardiovascular system a strain which may be measured and controlled, increased or decreased, as the physical condition of the subject may require,

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and may be applied under conditions which would not permit of the use of more violent exercise tests. Dr. Frost recently discussed the group of 489 cases of the type of murmur we have referred to above and states that his company has accepted 418 or 85 per cent of this group. The amount of insurance involved is \$2,795,812. They have been extremely fortunate in that they have had no deaths in this group.

Whether or not this test will enable us to segregate the good from the poor cases remains to be seen. Some feel that this method has no advantage over the usual "exercise test." Only experience over a long period of time can determine this. Meanwhile we will await with interest a further study of the experience developed in connection with the use of this unique method.

Before the days of "substandard insurance," the disposition of these cases was simple. They were all promptly declined and therefore gave the medical officer little concern, though we now fully realize that a great injustice was done the applicant and his family, and the insurance companies deprived themselves of good insurance risks. The companies were, until twenty years ago, rather secretive about their experiences in different classes of insured lives, and little was known outside of the home office of the company what their actual experience was, in a given class of cases. Of late years, however, the larger companies and particularly those doing the so-called substandard business have contributed an immense amount of information which has been of great benefit to the insurance world, to the medical profession, and, last but not least, to the insuring public. Life insurance statistics in reference to heart murmurs should be, and I believe are, of considerable value to clinical medicine. While it is true that examinations for life insurance are not made with the same degree of skill and employment of modern equipment as in clinical work, nor is so thorough and prolonged a study possible, still those examinations are made by men of at least average ability, and the companies are satisfied with the results obtained, and their experience reflects this confidence. We are sure that painstaking efforts on the part of examiners in an effort to secure more accurate data and complete reports would result in greater efficiency on the part of the examiner and more just action at the home office.

A study of this nature would be incomplete without a reference to the so-called "functional murmurs," murmurs occurring independently of any organic change, whether of the valves, myocardium or arteries, indicating merely disorder of function, no organic lesion being necessarily present. Some writers deny the existence of functional disorders of the heart altogether, being of the opinion that in every case some structural change not only exists but accounts for the malady. Such a view is held to be untenable by most medical directors. In a large percentage of cases, evidence of organic disease has not been detected because the examination has not been sufficiently thorough. It must also be remembered that the applicant's attitude, whether intentional or innocent, is to present the best side of his case to the examiner and to conceal facts which, if given, would often result in the detection of important impairments. Failure to obtain more details of personal history and present condition cannot, we feel, be entirely ascribed to the applicant's attitude, as has been done in the past, but is due, to a large extent, to failure of the examiner to interrogate and examine the applicant properly. This is clearly evidenced by the number of early deaths from heart disease incurred by the companies.

In the absence of any other abnormal finding such as thrill, hypertrophy, unusual pulse, blood pressure beyond normal limits, history of symptoms relative to the circulation, or history of disease predisposing to heart disease such as rheumatism, syphilis, chorea, etc., the assumption of competent valves and healthy myocardium is justified.

The observation of the reaction to muscular work is of value, and the bending exercise or "dips" will determine whether the myocardium is sound. An undue increase in pulse rate and failure to return to normal in three minutes, a drop or unusual elevation of diastolic blood pressure, raises doubt as to the quality of the myocardium and is often as useful in determining the value of a risk as are the more elaborate diagnostic methods. It is, of course, understood that these observations are not positive or unfailing evidence of myocardial disease, yet the test has the advantage of allowing us to separate the better from the poorer risks of such groups.

I would not suggest, however, that persons

with uncomplicated heart murmurs can be safely insured without some provision for an increased mortality. Where thousands of these cases are examined even by experts who give a most favorable prognosis in a given case, we realize that badly impaired hearts will creep into the group, no matter how carefully selected, and such risks will exert their unfavorable influence on the class as a whole. Notwithstanding the published experience of some companies and the very liberal view of the condition taken by eminent clinicians, few companies care to insure individuals with uncomplicated mitral regurgitant murmurs at standard rates.

Mitral stenosis, aortic insufficiency and stenosis give signs, aside from their character, location, and time of murmur, which establish their diagnosis, and they are usually detected and declined. Right sided valvular disease is rare and has little insurance interest. Systolic murmurs at the apex or at the second, third, or fourth left cartilage, at the aortic area, or at the region of the ensiform, comprise a large percentage of the murmurs which we have to consider.

With the advent of better trained and more skilled examiners in the field, some companies felt that they were in a position to obtain more accurate data, and certain companies, notably the New York Life, decided to make some investigations with certain types of these impaired risks. In this study the largest number of cases were those showing mitral regurgitation with and without transmission and with and without hypertrophy. A group of these cases was insured at an advanced premium rate, and after a time the mortality on these lives was computed, and the results published. There were included in these classes cases showing only the impairment noted. If irregular or intermittent pulse were also reported and other cardiac irregularities noted, these cases were not included in the study.

Recently, the Equitable, the Travelers Insurance Company and the New York Life Insurance Company have published the results of their experience, and there is a striking similarity in the experience gained. There were in this study some 20,000 cases, and it should be remembered that these lives studied were not examined by heart specialists but by general practitioners of medicine over widely distributed territory, though many contained in the groups were ex-

amined by the medical directors of the company at their home office or by men especially qualified to do this work. No doubt had these examinations been made by cardiologists, the results would have been different, but this, of course, for obvious reasons was not practicable from a business standpoint on account of the expense involved in requiring the finer diagnostic aids, such as the electrocardiogram, the *x*-ray, etc., to which a cardiologist often wishes to refer before making a definite diagnosis. Following the lead of these pioneers, many of the companies are now insuring applicants exhibiting heart murmurs, on a rated basis. We must, however, always remember, as Chester Brown has pointed out, that "we must always keep clinical experience separate from insurance experience. The best clinicians assure us about certain forms of impairment and certain histories, and yet for some reason we have the feeling that groups of these individuals must not be insured the same as average-health persons; and that we must keep in mind that the insurance prognosis and the clinical prognosis are entirely different."

In spite of most careful examinations by ordinary clinical methods, and in spite of what clinicians teach us about the insignificance of heart murmurs, we know we *do* get an excessive mortality from circulatory disease, relatively higher at the younger ages and in the earlier policy years. The increased proportion of deaths from circulatory disease and nephritis bears out these conclusions. It may be that the murmur per se is not alone responsible for the high mortality. We believe that often other signs are present, though not detected by the examiner or not reported by him, which offers an added factor.

Statistics pertaining to life insurance mortality are based upon the actual experience of the companies, and I would remind you that the following statements are based upon figures compiled jointly by several of the leading insurance companies doing a substandard business which have accepted on a substandard basis the class of risks above referred to.

Before proceeding with statistical evidence pertaining to this subject, I would digress for a moment to explain rather briefly, for the benefit of those of you who are unfamiliar with the treatment of these cases by life insurance companies, by what means and upon what basis they

are handled, based as they are upon medico-actuarial practices.

To determine whether the death rate of any group of lives has been greater or less than normal, we compare the number of deaths with that number which would be expected in the group by a normal table of mortality—the result being expressed as a percentage. For example, if a given group shows 175 deaths over a given period of time, but the number expected according to the normal or standard mortality rate is 100, then the group would be said to show a mortality of 175% of the normal. As an illustration by way of interpreting this ratio, we will assume that we are considering an applicant, age 35, who has a mitral regurgitant murmur with slight hypertrophy, and no other circulatory or etiological impairment. Our practice dictates that this case should be rated 200%. This 200% rating does not mean that the applicant's actual cash premium is twice that of a normal life at this age; but it does mean that there is an added hazard or risk owing to this impairment for

TABLE I

## MITRAL REGURGITATION WITHOUT HYPERTROPHY

Company	No. of Cases	Period of Study	Expected Deaths on Standard Risks	Actual Deaths	Ratio of Actual to Expected
N. Y. Life..	13,219	1896-1922	427.4	805	188%
Equitable .....	....	....	....	....	159%
Travelers ....	....	....	....	....	179%
42% of these deaths were from heart disease.					

TABLE II

## MITRAL REGURGITATION WITH HYPERTROPHY SUFFICIENT TO REQUIRE ADDITIONAL RATING

Company	No. of Cases	Period of Study	Expected Deaths on Standard Risks	Actual Deaths	Ratio of Actual to Expected
N. Y. Life.....	3,633	1896-1922	89.7	221	246%
Equitable .....	....	....	....	....	391%
Travelers .....	....	....	....	....	240%
59% of these deaths were from heart disease.					

TABLE III

## MITRAL REGURGITATION WITH LITTLE OR MODERATE HYPERTROPHY AND HISTORY OF INFLAMMATORY RHEUMATISM

Company	No. of Cases	Period of Study	Expected Deaths on Standard Risks	Actual Deaths	Ratio of Actual to Expected
N. Y. Life.....	2,538	1896-1921	115	361	315%
Equitable .....	....	....	....	....	429%
Travelers .....	....	....	....	....	238%
57% of these deaths were from heart disease.					

which an extra charge must be made, which in this case on the ordinary life plan would be \$9.87 per thousand. It is common practice for most companies not to issue insurance to any applicant who rates over 225%.

In view of these reports from reliable sources, it must be apparent that the class of risks just discussed do not show an average mortality. It is also evident that an increased percentage of deaths occurs from circulatory disease. Rogers and Hunter of the New York Life report 42 per cent of deaths as due to heart disease where less than 4 per cent would be expected in a corresponding group of standard lives. Dr. Grosvenor of the Travelers Insurance Company reported 42 per cent of the deaths from circulatory diseases in contrast to an expected 5.5 per cent.

Studying these reports from another angle not indicated above, that is, in respect to age of entry of the risks, the natural impression would be that the mortality would be *less* at the younger ages rather than in *later* adult life. The reverse, however, is true, as shown by Table IV.

TABLE IV

## SHOWING EXCESSIVE MORTALITY IN YOUNGER ENTRANTS

N. Y. Life Ins. Co.		Travelers Ins. Co.	
Mitral Regurgitation Without Hypertrophy		Mitral Regurgitation Without Hypertrophy	
Ages at Entry	% Actual to Expected Deaths	Ages at Entry	% Actual to Expected Deaths
15-24	218%	-29	178%
25-39	202%	30-44	164%
40-49	172%	45 plus	125%
50 plus	130%		

Another interesting fact brought out in these reports is the variation of the mortality relative

to the duration of the policy. As great care was used in the selection of these risks, one would assume that the mortality in the earlier years would be considerably less than in the later years. Table V, however, shows this not to be true, as high mortality appears to be in the earlier rather than in the later policy years.

TABLE V

SHOWING EXCESSIVE MORTALITY IN EARLY POLICY YEARS

<i>N. Y. Life Ins. Co.</i>		<i>Travelers Ins. Co.</i>	
Mitral Regurgitation Without Hypertrophy		Mitral Regurgitation Without Hypertrophy	
Policy Years	% Actual to Expected Deaths	Policy Years:	% Actual to Expected Deaths
1- 5	202%	1	243%
6-10	172%	2	74%
11-15	208%	3	240%
16 plus	131%	4	135%
All years	188%	5	139%
		6 & later	175%
		All years	169%

We are dealing, therefore, as Dr. Frost has pointed out "with an impairment, which, in spite of careful selection, carries an excessive mortality with increasing hazard of death from circulatory disease—a mortality relatively higher at the younger ages than at the older, higher in the earlier policy years than at the later, and at all times excessive."

It might be of interest to indicate here what the common practice of insurance companies is in rating this class of risks. The company which I am associated with follows the ratings indicated in Table VI.

We are of the opinion that our examiners in the field are becoming better qualified and more capable of furnishing us with data which are suf-

TABLE VI

SYSTOLIC APICAL MURMUR, TRANSMITTED TOWARD THE AXILLA: USUALLY SOFT BLOWING IN QUALITY (MITRAL REGURGITATION)

Ages at Entry	Rated
10-20	170%
21-30	170%
31-40	180%
41-50	190%
51-55	200%
56 & over	Not accepted

If hypertrophy is present, add 20 to 40 points, depending upon the degree.

With history of rheumatism or other allied infection, add 40 points.

efficient to enable us to place a more proper value on a risk than formerly. Better medical schools, more adequate training, and more attention to the responsibility undertaken account for this improvement. This is not only true of the large cities but is, in fact, quite general. With this in mind, the companies are prompted to extend their scope of activities quite freely and accept reports on the lives of impaired applicants showing certain types of heart murmurs.

TABLE VII

"FUNCTIONAL MURMURS," CONSTANT—NOT TRANSMITTED, APICAL. FIRST SOUND WELL HEARD

Examined at Home Office or by especially qualified examiner, rated more leniently.	
Ages at Entry	Rated
10-20	120%
21-30	120%
31-40	135%
41-50	150%
51-55	175%
56 & over	200%



## CORONARY DISEASE\*

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THE knowledge of clinical disorders of the coronary circulation had its origin in uncertain sources of the seventeenth century. Even the critical Harvey<sup>1</sup> leaves us in some doubt as to the exact pathology in the oft-quoted case of Sir Robert Darcy, who had complained of frequent "distressing pain in the chest, especially in the night season; so that dreading at one time syncope, at another suffocation in his attacks he led an unquiet and anxious life. He tried many remedies in vain, having had the advice of almost every medical man. The disease going on from bad to worse, he by and by became cachectic and dropsical, and finally, grievously distressed, he died in one of his paroxysms. In the body of this gentleman we found the wall of the left ventricle of the heart ruptured, having a rent in it of size sufficient to admit any of my fingers, although the wall itself appeared sufficiently thick and strong; this laceration had apparently been caused by an impediment to the passage of the blood from the left ventricle into the arteries." Riesman<sup>2</sup> credits Edward Jenner with the recognition of the dependence of John Hunter's anginal attacks upon coronary sclerosis. Parry in turn applied the information gained from his friend Jenner to his own practice and reported several similar cases, which were confirmed by necropsy. The medical profession has paid a costly tribute of illustrious physicians to coronary affections. Among these have been Charcot, Nothnagel and William Pepper. Of the last named, Osler<sup>3</sup> wrote, "The most brilliant and devoted physician of his generation in the United States died with coronary arteries like pipe-stems."

Affections of the coronary blood vessels and circulation are among the limited group of clinical conditions whose recognition preceded an accurate knowledge of the anatomy and physiology of the system involved. This anomalous situation led Spalteholz<sup>4</sup> to remark, "Eine rein experimentelle Arbeit hingegen ohne genaue Kenntnis des anatomischen Verhältnisse führt

nur zu durchaus unsicheren Schlüssen; sie heisst ein Haus bauen ohne Fundamente!"

Singularly the earliest exact observations of Cohnheim<sup>5</sup> rejected the suggestion of anastomoses in the coronary arteries advanced by Weigert<sup>6</sup> and thus led to a controversy which carried down to the past decade. According to the Cohnheim school the coronaries were end arteries and occlusion led to death. By experimental studies Porter<sup>7</sup> deduced the fact that arrest occurred in direct ratio to the size of the coronary branch ligated. He was inclined to the belief that such anastomoses as existed were too inadequate for collateral circulation. Hence, "rapid closure of a coronary artery puts an end to the nutrition of the area which it supplied." Contrary to Cohnheim he affirmed that resumption of cardiac action attended removal of the ligature and massage. Miller and Matthews<sup>8</sup> encountered very interesting results in ligation studies, in that ligation of either of the main branches of the left coronary artery could be accomplished without ill effect. However, left ventricular arrest always attended ligation of the descendens branch 25 mm. or less from its orifice after previous ligation of the circumflex. No early cardiac disturbance developed on ligation of either of the two main branches of the descendens, but in from 1 to 3 months death supervened after acute symptoms of cardiac insufficiency.

From the anatomic viewpoint Hirsch and Spalteholz<sup>9</sup> established the existence of anastomoses (Fig. 1). They also pointed out the constant occurrence of a smaller infarct than the area supplied by the occluded vessel, because of the collateral circulation. Later Gross<sup>10</sup> and Spalteholz<sup>11</sup> independently published authoritative monographs on the blood supply of the heart and both confirmed the existence of arterial anastomoses. From the former source<sup>10</sup> the following coronary distribution may be abstracted. The right coronary, arising from the right anterior sinus of Valsalva, emerges between the aortic and pulmonic roots to half-encircle the heart in the auriculo-ventricular sulcus. Its branches supply the entire right ventricle with

\*From the Department of Medicine, University of Wisconsin. Read before the annual meeting of the Minnesota State Medical Association, Duluth, Minnesota, June 30 to July 2, 1927.

the exception of the left third of the anterior wall. Furthermore, certain of its branches supply the right half of the posterior wall of the left ventricle and a small strip of the interventricular septum. The left coronary artery takes its origin in the left anterior sinus of Valsalva and passes under the left auricular appendage to divide into its important branches, the descendens and the circumflex. The descendens follows the anterior interventricular groove to round the cardiac apex and ascend the posterior interventricular furrow, supplying many branches to both ventricles. The left circumflex branch follows the auriculo-ventricular groove to the left and half-encircles the heart. Its ultimate arborizations reach the posterior surface of the left ventricle. The left coronary artery supplies the major portion of the left ventricle with the exception of the above stated contributions of the right coronary artery to the right half of the posterior wall and the interventricular septum. The left coronary artery also supplies nutrition to the small anterior portion of the right ventricle not supplied by the right coronary artery as well as the small anterior strip of the interventricular septum. The remainder of the septum and of the papillary muscles receive branches from both major coronary sources (Fig. 2). Particular physiologic and clinical importance attaches to the blood supply of the conducting mechanism of the heart. In 60 per cent of studied hearts Gross determined a right coronary supply to the sino-auricular node. The auriculo-ventricular node was supplied by the right coronary artery in 92 per cent. The right limb of the bundle is nourished by the left coronary artery and the left limb by branches of both coronary arteries. A peculiarly abundant blood supply is afforded the conducting paths. The inconstancy of the auricular blood supply does not admit of generalization.

Certain small vessels, notably the *Arteriæ telæ adiposæ*, may play an important rôle in establishing collateral circulation in event of interference in the major channels. The compensatory mechanism of nature in developing anastomoses in the coronary circuit in the face of impending occlusion of the accustomed pathways was first hinted by Weigert.<sup>6</sup> Later, Dock<sup>11</sup> wrote, "The capillary anastomosis, however, may become enlarged as a result of disease, a fact of great importance in certain cases. The rapid-

ity with which an obstruction forms is, therefore, decisive in regard to the question of collateral circulation." Gross attributes to age a considerable importance in preparing such physiologically adequate anastomoses. This question will assume an increasing clinical pathological significance. The brilliant studies of Wearn<sup>12</sup> on the veins of Thebesius give an unexpected importance to their function in event of coronary embarrassment. By a mechanism to which he applies the term of a "shunt system," these small vessels may take on a large share of the load of venous discharge into the heart chambers in case of venous hypertension, and on the other hand may partake of a not inconsiderable

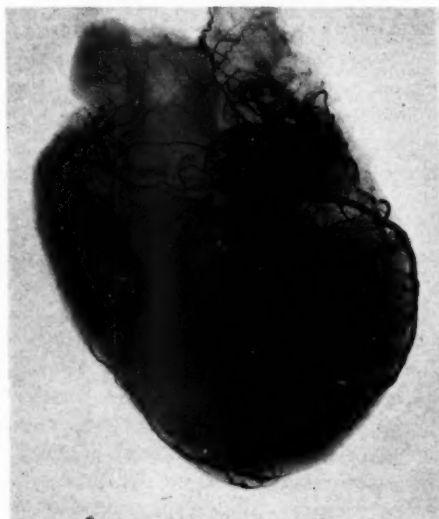


Fig. 1. Barium injection, coronary arterial system of the cat (by Drs. Jos. M. Steiner and Robert Drane).

nutrient function on coronary arterial interference.

The blood flow in the coronary arteries shows a definite increase at the beginning of systole and at the beginning of diastole. With cardiac contraction there is obviously a compression of the intramural branches of the coronary arteries with emptying of their contents. Thus flow through the myocardium is favored. Certain observers believe that the coronary arteries receive vasoconstrictor fibres from the vagus nerve and vasodilator fibres from the sympathetic system. Others claim that the coronary vessels are without vasomotor control.

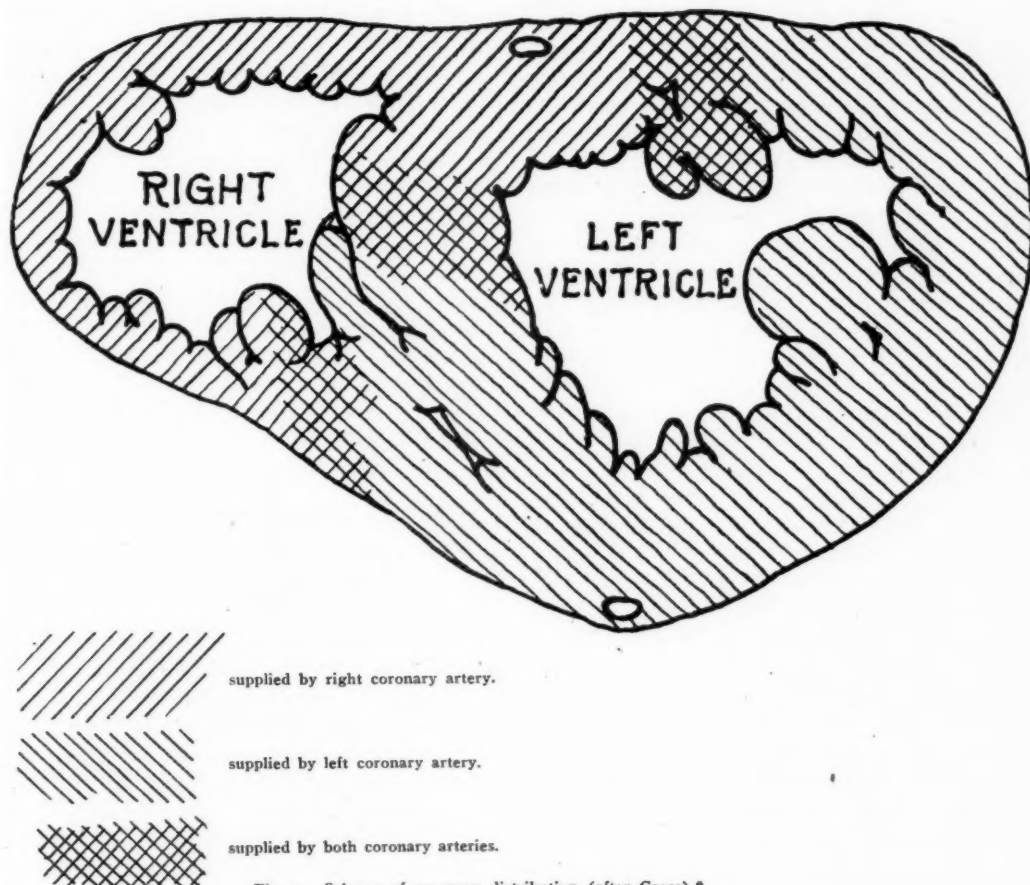


Fig. 2. Schema of coronary distribution (after Gross).\*

The latter position casts a serious doubt on the occurrence of coronary spasm, although as a clinical explanation for anginal attacks terminating fatally without demonstrable gross or histologic lesions, this time-honored term will doubtless hold sway until a better one takes its place. Of the demonstrable lesions affecting the coronary arteries three are of primary importance, namely atheroma (or sclerosis), embolism and thrombosis. Luetic aortitis with narrowing or occlusion of the coronary orifices is of more than passing interest. Of the primary pathologic lesions of the coronary system embolism is least common and from a practical standpoint almost negligible. Dock<sup>13</sup> relates a clear cut case of coronary embolism established by necropsy, in which the ulceration and rupture of an "atheromatous abscess" in the left descendens led to embolism in its smaller subdivisions with infarction.

Especial attention will herein be directed to coronary sclerosis and to its not uncommon outcome, thrombosis.

The clinical syndrome or entity of angina pectoris is so inseparably linked with a disturbance of coronary circulation in the minds of the vast majority of practitioners that it must receive our consideration before entering upon a discussion of coronary sclerosis and thrombosis. An overwhelming literature has grown about this subject and it is well to crystallize one's ideas as to the status of our information. Several positions are held relative to the pathogenesis of angina pectoris. Huchard<sup>14</sup> maintained that an endarteritis of the coronary vessels was the pathologic lesion of angina pectoris, whereas with great vehemence Allbutt<sup>15</sup> has held that the essential

\*This figure is reproduced through the courtesy of Paul B. Hoeber, Inc.

pathology is in the aorta. The intermittent claudication theory receives somewhat less support from modern cardiologists. Acute dilatation of the heart was advanced by Lauder Brunton in explanation of angina. At the present time there is a definite tendency to strip away all qualifying terms, such as pseudo and the like, which tend to befog the true significance of the disorder. Vaquez<sup>10</sup> holds that angina pectoris is characterized by three outstanding symptoms, "Pain in the chest, situated usually behind the sternum, more rarely precordial; radiating pains in the upper part of the body, notably in the left arm and shoulder; and a sense of imminent death or dread which goes hand in hand with the pain." From this framework the clinical picture can readily be drawn from our individual experiences. Particularly should attention be directed to Vaquez's arbitrary subdivision of the condition into angina of effort and angina of decubitus. Depending upon the pathologic viewpoint his further discussion of these types may or may not be logical. At least the idea serves as an interesting point of clinical attack.

Coronary sclerosis may occur as a part of a general athero-sclerosis. Syphilis is an undoubted etiologic factor in coronary sclerosis but of less frequent incidence than commonly held. The infectious diseases are responsible only in the same proportion as they induce sclerotic changes in other small vessels. Gout, diabetes mellitus and lead-poisoning have been mentioned in like relations. Other toxins, endogenous and exogenous, may act similarly. Hypertension may be a factor. Obviously age, sex, effort or occupation and habits have their influence. Pathologically coronary sclerosis is typically a lesion of the fifth decade or upward, affecting the male sex more commonly and, by preference, those of vigorous habit. Overeating, alcoholic overindulgence and the excessive use of tobacco may have some undetermined influence in its development.

The result of coronary sclerosis which is insufficient to induce occlusion of a major branch of the coronary arterial system per se, is gradually advancing fibrosis of the myocardium. The basic process in the vessels is usually an obliterating endarteritis. Quain's<sup>17</sup> earlier idea of a fatty change in the myocardium from sclerosis of the coronary arteries is no longer maintained. Weigert<sup>6</sup> and Huber<sup>18</sup> on the Continent and Turner<sup>19</sup> in England directed attention to the fibroid

change in the myocardium resultant upon coronary sclerosis. The last named in explanation wrote, "It would seem that by blocking up of some branch of the coronary artery, with its ramuscles, a certain tract of the myocardium had become deprived of blood."

As to the clinical importance of such changes in the coronary arteries and in turn the myocardium, especially as an etiologic agent in angina pectoris, Kretz<sup>20</sup> expressed serious doubt. From an extensive study of the pathology of coronary arterial disease Benson and Hunter<sup>21</sup> concluded that sclerosis alone "rarely if ever produces serious effects." Willius and Brown<sup>22</sup> in a careful analysis of 86 cases of coronary sclerosis coming to necropsy determined the universal presence of myocardial degeneration. Anginal attacks in over a quarter and evidences of progressive myocardial failure in an even higher proportion were striking facts gleaned from the histories. The termination was sudden in thirty-two of their eighty-six cases.

Certain it is that the margin of safety in the coronary circulation is wide. Hence, sclerotic changes may be quite advanced before leading to myocardial insufficiency or signs attributable to coronary occlusion. Indeed, as has been previously pointed out, sclerosis favors anastomosis and collateral circulation. Oberhelman and Le Count<sup>23</sup> conclusively proved that two factors, namely pre-existent channels and time to establish anastomoses, determined the outcome in coronary occlusion. In a word, where there had been previous sclerosis, adequate anastomoses existed; but as a rule without antecedent or with minor vascular changes inadequate or no anastomoses existed. In few cases were collateral channels found in the absence of arterial or myocardial disease.

The clinical picture of coronary sclerosis, if angina pectoris be omitted, is poorly defined and hazy. Osler's<sup>3</sup> designation of the physical type in angina pectoris holds here: "The robust, the vigorous in mind and body, the keen and ambitious man, the indicator of whose engines is always at 'full speed ahead.' There is, indeed, a frame and facies at once suggestive of angina—the well 'set' man of from 45 to 55 years of age, with military bearing, iron-grey hair, and florid complexion." To the physical type may be added the syndrome of angina pectoris, if one be of the Huchard school. Indeed, one is led by the



antecedent history of coronary thrombosis to include a group of so-called cardiac pains under coronary sclerosis. The almost constant incidence of indefinite attacks of indigestion without apparent reason following effort has been remarked in histories of coronary thrombosis. It is entirely proper to include such ominous warnings as indicative of coronary sclerosis. Symptoms of circulatory incompetency may express the myocardial defect dependent upon coronary sclerosis. Particularly does unaccountable dyspnea fall under this heading; and in the senile type of coronary sclerosis, paroxysmal dyspnea at times succeeds effort. Arrhythmia of varying orders may be the sole expression of coronary interference. An unusual physical weakness and lack of stamina has marked certain cases, but it is impossible to accurately evaluate the responsibility of the coronary involvement. In brief, a clear clinical picture of coronary sclerosis is not obtainable; the major features are assumed by the inference of its responsibility for the foreboding symptoms of coronary thrombosis. The clinical seriousness of coronary sclerosis is apparently not determined by its extent or degree. It is especially significant as the forerunner of coronary thrombosis.

By tacit consent clinicians in this country have come to regard coronary disease as thrombosis. Obviously this position is incorrectly taken; but it doubtless grows from the preëminent contributions of American clinicians to the knowledge of this subject and from the well-defined clinical entity established by their efforts. Be that as it may, the common recognition of coronary thrombosis antemortem is a development of the past twenty years. With this progress has come a proportional decrease in the lay diagnosis of acute indigestion made in cases of sudden death by medical men. Further stimulation to the study of coronary thrombosis has attended the appreciation of the fact that it is not always immediately fatal nor for that matter inevitably fatal after a period of years. Dock<sup>11,12</sup> gave the first American description of the condition and his thoroughgoing analysis, at the bedside and on the necropsy table, deserved a better fate than the comparative oblivion which attended the contributions. Herrick<sup>24</sup> after a lapse of sixteen years revived the interest in the clinical study of coronary thrombosis in this country. Among the contributors to the American literature have been

Pardee,<sup>25</sup> Blumer,<sup>26</sup> Longcope,<sup>27</sup> Riesman,<sup>2</sup> Wearn,<sup>28</sup> Willius,<sup>29</sup> Gordinier,<sup>30</sup> Christian,<sup>31</sup> Levine<sup>32</sup> and Hamman.<sup>33</sup> The last named has given an exceptionally able résumé and analysis of the present status of our information on the subject.

If the relationship of coronary sclerosis to thrombosis be granted, obviously the etiologic factors therein discussed will have a similar bearing in the present relation. Arteriosclerosis appears to be the sole constant in the pathologic background of thrombosis. In large measure dependent on this factor will be the degree and adequacy of the collateral coronary circulation. Age may lend a measure of aid in this direction. The general condition of the patient unquestionably plays a part in determining both the occurrence and the result of coronary thrombosis. Important in the clinical manifestations and the prognosis of this condition are the size and the particular branch of the coronary vessels occluded. Not uncommonly complete occlusion of a coronary vessel may occur without symptoms or histologic evidence of disturbed myocardial nutrition. In cases of coronary thrombosis giving rise to clinical symptoms the descendens branch of the left coronary artery is the occluded vessel in an overwhelming majority.

Obratzow and Strachesko<sup>34</sup> grouped the clinical manifestations of coronary thrombosis under three headings:

1. Status anginosus—prolonged pain
2. Status dyspnoeicus—extreme dyspnea and orthopnea
3. Status gastralgicus—severe epigastric pain.

Classically the occlusion of a considerable branch of the coronary artery is attended by a severe vise-like pain beneath the lower end of the sternum or in the epigastrium. This pain is more protracted than that of simple angina pectoris, although it may be the culmination of repeated attacks of typical angina. It may last for hours or for days. While more severe than true angina, the pain of coronary thrombosis has a more circumscribed distribution and manifests a lesser tendency toward radiation. This status anginosus is particularly refractory to treatment. The nitrites have no influence on its course and even morphine may be totally ineffectual in controlling the pain. The coincidence of nausea and vomiting or the occasional relief of the milder attacks with the eructation of gas or the passing of much clear urine may prove very misleading.

To add to the confusion, tenderness and rigidity may be present in the upper abdomen. Dyspnea is a very common symptom and the subjective expression of this distress is frequently more striking than the objective signs. This fact may definitely suggest coronary occlusion. Profound weakness or asthenia supervenes. Diarrhea is common. Somewhat later, cough, hemoptysis, vasomotor flashes, sweating, convulsions and coma may occur. As to the mental state a perfect appreciation of the situation is the rule with pronounced *angor animi*. Death may eventually be welcomed as a release from the agonizing pain.

The physical status of the patient is striking. Libman<sup>35</sup> recalls the description of the unusual cast of the skin originally applied by Sansom to certain cases of aortitis, a "leaden color covering an earthy tint." The dyspnea has been described. Acute overdistention of the lungs is common and basal congestive râles are early found in all cases. An ominous quiet is remarked in the precordial activity. The imperceptible apical impulse is in strange contrast to the evident circulatory embarrassment. Cardiac dullness may be extended. The heart sounds are feeble and frequently of an embryo-cardiac order. Arrhythmias, particularly auricular fibrillation and flutter, are commonly encountered. Heart block and pulsus alternans are feared prognostic signs of altered conduction. Rapid pulse is constant and concurrently the blood pressure is sharply depressed with a low pulse pressure. Particular significance attaches to the characteristic fine pericardial friction which appears within eighteen to thirty-six hours after coronary occlusion and is heard over a very small area. The fine quality and the evanescent nature of this circumscribed friction probably account for its frequent oversight, but its detection after an anginal attack clinches the diagnosis. Failure to determine its presence may depend upon the above difficulties, but it is not constant. Gorham<sup>36</sup> remarked an unusual tendency for the disappearance and re-appearance of this sign. The pericardial involvement depends upon the infarction's impingement on this serous membrane. Absence of the *dorsalis pedis* pulse has been pointed out by Riesman<sup>3</sup> in cases of coronary thrombosis. Its significance is inferential. A fever of from 100° to 102° F. commonly succeeds this accident and Libman<sup>37</sup> has called attention to an interesting

leukocytic reaction to coronary thrombosis. In one-half of such cases the leukocytes ranged between 15,000 and 30,000 with 78 to 91 per cent polymorphonuclears. A leukocytosis is constant and at times begins within two hours after the attack and independent of attendant pericarditis. The necrosis of infarction probably calls out this reaction. Occasionally hydrothorax, general anasarca and engorgement of the liver may occur. Less commonly albuminuria, suppression of urine, and Cheyne-Stokes' respiration have been remarked. Finally the subsequent development of embolic phenomena may conclude the early picture. A glance at the dual nutritive responsibility of the two major coronary arteries will prove the fallacy of attempting to designate which coronary artery is thrombosed by the circuit in which evidences of embolism appear.

Two cases of characteristic coronary occlusion are related:

*Case 1.*—E. H., sixty-four years of age, an obese diabetic, was readmitted to the Wisconsin General Hospital on November 8, 1925, with a history of abdominal distress. Fifteen days previously he had suffered from severe "gas pains," which were relieved by sodium bicarbonate. This relief was quite temporary and the gas rapidly reformed. On the following day, again succeeding the ingestion of food, the "gas pains" recurred and a "dead feeling" in the stomach with marked anorexia supervened. These symptoms continued for five days when there were added epigastric oppression and dyspnea. On the seventh day after the onset pain appeared in the left shoulder and radiated down the left arm. This pain was described as sharp or neuritic and was treated with some relief by rubbing. Jaundice with clay colored stool was noted two days before admission, but continued for only one day, when excruciating pain in region of the heart developed with marked dyspnea. The pain was described as "feeling as if he were rubbing two hands about heart." It persisted for one-half to three-quarters of an hour and the patient remarked that "if it had lasted longer, would have been unable to stand it." Recurrence of this pain in the morning led to his admission. Dyspnea had grown progressively worse since onset.

The pertinent findings follow: The apprehension was apparent. Cyanosis was moderate. The breathing was labored. Signs of fluid at the right base were established. Many râles, large and small, moist, sonorous and sibilant were heard through both chests. Widening of the cardiac dullness was determined. Tachycardia (106) and distant heart sounds were remarked. The blood pressure was read at 100/74. There was free fluid in the abdomen. The peripheral vessels were slightly thickened. The leukocytes numbered 11,000 with 74 per cent polymorphonuclears.

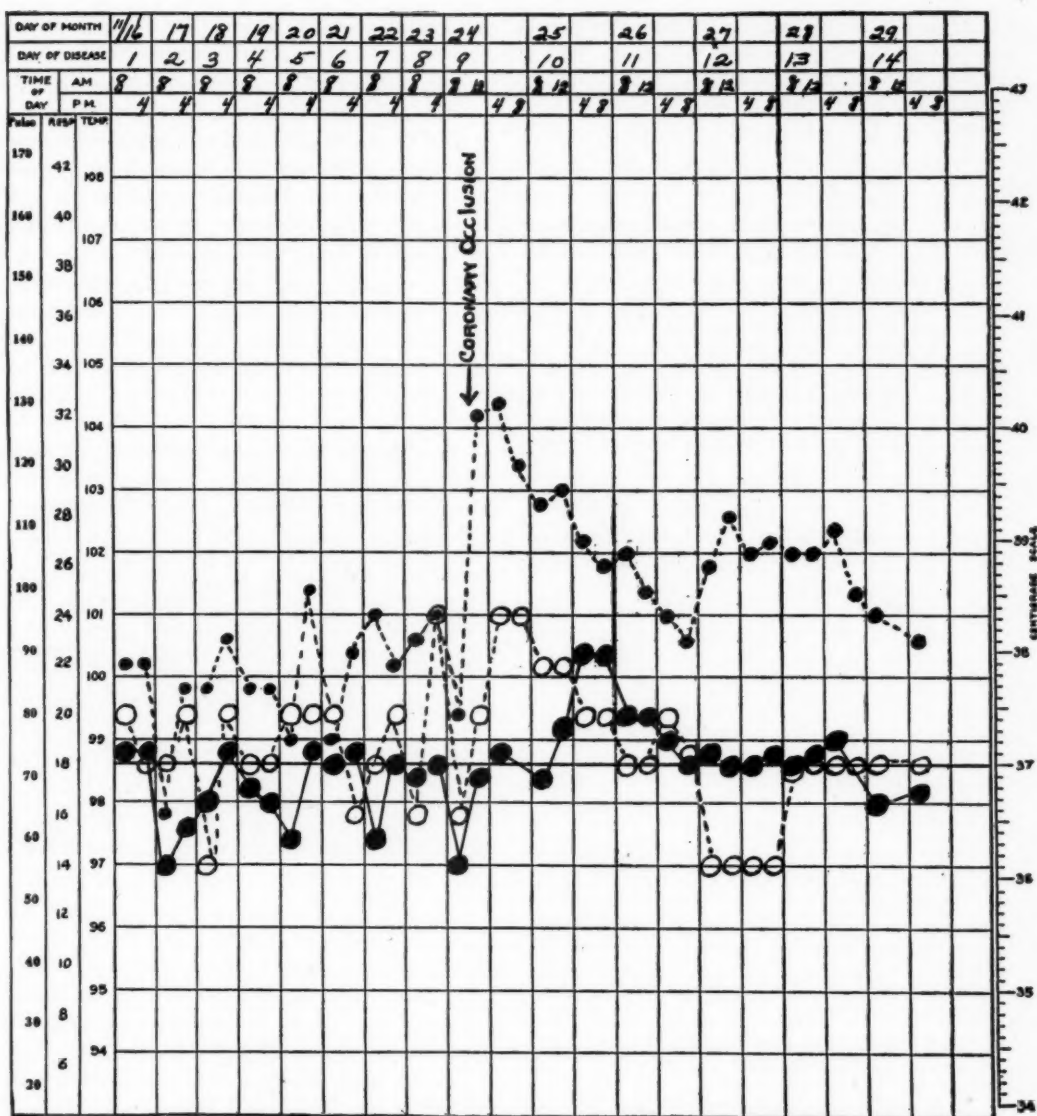


Fig. 3. Graphic chart of Case 2.

T ●——●  
 P ●——●  
 R ○——○

A pericardial friction had appeared on the second day. The evidence of pulmonary congestion persisted. The liver was palpably enlarged. Edema appeared in the arms and legs. An electrocardiogram showed auricular fibrillation. T was flat in all leads and the voltage was likewise low in all, substantiating the clinical opinion of an advanced myocardial degeneration. There was a suggestion of a plateau on the down-stroke of  $R_2$  and  $R_3$  from which the T waves arose. Inconstant bigeminus appeared. The peripheral

evidence of circulatory incompetence steadily abated. The pericardial friction persisted until death twelve days after admission and the electrocardiogram a day before the termination showed a maintained low voltage with  $T_1$  flat and  $T_2$  and  $T_3$  negative. The P R interval was 0.24 seconds and the QRS 0.07 seconds. Fibrillation had disappeared.

The immediate circumstances of his death were quite interesting. The day had been very quiet and comfortable. The patient received a large group of friends

and enjoyed their visit greatly. On their departure he was still perfectly comfortable and in the best of spirits. He denied being fatigued. Ten minutes later he was found dead without evidence of a struggle.

**Case 2.**—C. Z., a male, forty-eight years of age, engaged in office work, was admitted to the Wisconsin General Hospital on November 16, 1926, with a thrombo-phlebitis of the left femoral and long saphenous veins. Subsequently similar changes developed in the right leg. Eight days after admission while being moved cautiously to change the bedding patient experienced a sharp syncopal attack. Extreme substernal oppression was remarked and as the patient expressed himself, "There did not seem to be enough air in the room." Orthopnea was noted with a peculiar inspiratory difficulty. The pulse was rapid (136), regular and of small volume. The marked depression lasted 15 minutes, but orthopnea and nausea persisted throughout the day. Several short coughs at the onset were unproductive. The patient volunteered the information that he had had a restless night prior to this experience because of slight indefinite abdominal discomfort and further that with the onset of the attack he had felt unable to summon help. The leukocytes numbered 10,350.

The succeeding day the skin was leaky. The pulse remained small and running. The blood pressure registered 86 mm. systolic and 72 mm. diastolic. The temperature was elevated to 100.4 F. (Fig. 3). A soft to and fro pericardial friction rub was heard in the fourth left interspace close to the sternum and there appeared also a soft apical systolic murmur. The second day following the attack found definite circulatory improvement with disappearance of the friction rub. The blood pressure was read at 98/65. The following day, however, there recurred an attack similar in type but less in severity than that above described. The collapse was not as profound. The pericardial friction rub reappeared. Within nine hours a peculiar arrhythmia made its appearance. Occasional strong beats with clear muscular tone succeeded series of weaker contractions which suggested the runs of a kettle drum. The blood pressure was 82/68. Again the next day a mild syncopal attack was experienced. The arrhythmia described continued for two days. Electrocardiographic study was impossible at this time but previous and subsequent tracings showed no abnormality. The blood pressure did not resume its normal level for three weeks, but the general condition improved more rapidly. For a period of four months after the initiating symptoms occasional attacks of nausea and weakness were reported. The patient is steadily increasing his physical effort without apparent ill effects or setbacks, seven months after the coronary accident.

Case 1 represents the clinical type of coronary thrombosis which is most commonly mistaken for a surgical condition of the upper abdomen. The occurrence of jaundice made the problem even more difficult. Case 2 may be termed one of embolism from the femoral thrombosis, if the

pulmonary capillary bed be assumed to have been traversed, or coronary thrombosis.

Repeated mention has been made of the electrocardiographic changes in coronary thrombosis. Pardee<sup>22</sup> described a peculiar plateau succeeding the R wave, from which elevation the T arose, in cases of recent coronary occlusion (Fig. 4). Later this plateau seemed to descend on the R wave and the T became very deep. Smith<sup>23</sup> followed up an excellent experimental study by observations on eleven clinical cases of coronary thrombosis and concluded that the electrocardiogram in such cases showed a negative T<sub>1</sub>, T<sub>2</sub> and

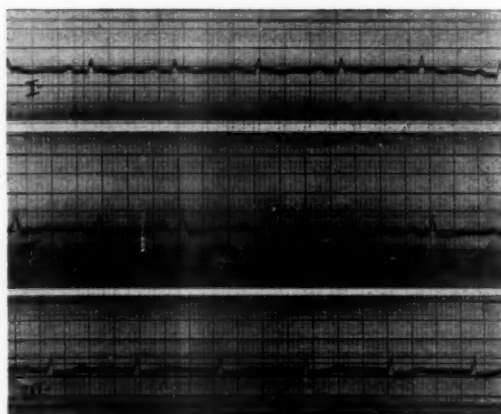


Fig. 4. Electrocardiogram, succeeding thrombosis of the descendens branch of the left coronary artery.

T<sub>3</sub> ultimately or two of these waves were negative. The QRS complexes were of low amplitude. In this report he refers to the case of a wound of the myocardium repaired by Davenport at Cook County Hospital in which it was necessary to ligate the descendens branch of the left coronary artery. The T waves were negative in the three leads for a time postoperatively, but eventually became upright in leads I and II. Although electrographic changes may be wanting in coronary thrombosis, their occurrence is of great diagnostic importance.

Aside from its importance in prognosis and treatment the exact diagnosis of coronary thrombosis has a very practical application in the control of two divergent surgical procedures. These measures must be considered separately. In the first place the growth of surgery in the treatment of angina pectoris necessitates its differ-



entiation from coronary thrombosis, in which operation would not only be contraindicated but even very dangerous. The history of the present or prior attacks may be helpful. Digestive symptoms are less common in angina pectoris. The greater severity, longer duration, lower localization and lessened tendency for radiation of the pain of coronary thrombosis must be borne in mind. Furthermore, the pulse is markedly elevated, the heart action weak and the blood pressure depressed in coronary thrombosis as compared with negligible or inconstant changes in these factors in angina pectoris. Finally the febrile reaction, leukocytosis, pericardial friction and electrocardiographic changes incident to coronary thrombosis are not seen in angina pectoris. As a therapeutic test the pain of coronary thrombosis is not relieved by the nitrites, contrasting sharply with the relief of angina pectoris. It should not be necessary to await signs of remote embolism to make the distinction.

Similar details must be utilized in differentiating coronary thrombosis from upper abdominal conditions. The nausea and vomiting, epigastric pain, tenderness and rigidity and even jaundice of coronary thrombosis certainly direct the attention to the abdomen rather than to the thorax. Cholecystitis, gallstone colic, renal colic, Deitl's crisis, acute pancreatitis and rupture of a hollow viscus are among the erroneous diagnoses in coronary thrombosis. A careful history may elicit the previous occurrence of mild anginal attacks with especial relation to the ingestion of food. Further the occurrence of indigestion after exertion and finally the relation of exertion itself to the onset of the painful seizures may be important leads toward the diagnosis of coronary thrombosis. Most of the acute abdominal conditions occur at an earlier age than does coronary thrombosis. Subjective or objective dyspnea, so common and so striking in coronary occlusion, are not outstanding, if present, in abdominal conditions. Study of the exact position and reference of the pain may differentiate. The feeble pulse and heart sounds, low blood pressure, pericardial friction rub, embolic phenomena and electrocardiographic changes of coronary thrombosis are evidences which the careful clinician will elicit to avoid a needless abdominal operation in debatable cases. After the acute phase of the painful attack one of the dyes or the opaque substances for the visualization of the gall blad-

der and the urinary passages, respectively, may be called upon for differentiation. Lastly a routine neurologic examination will rule out gastric crises of *tabes dorsalis*.

The immediate prognosis of coronary thrombosis is determined by the size and location of the vessel occluded, the factors responsible for an adequate collateral circulation and the time element in the process of thrombosis. The trend of the blood pressure is an excellent guide in the early prognosis. A falling pressure or a maintained low level is an ominous sign, as is also evidence of decompensation. Immediate death from ventricular fibrillation may result, but the ruling opinion is that sudden death on the primary occlusion is unusual. Apparent recovery may be succeeded by an unexpected termination after days or weeks. A complete functional recovery not infrequently succeeds coronary thrombosis, even though a considerable branch be occluded, by reason of adequate collateral circulation or canalization of the thrombus. Rupture of the heart may occur through the area of infarction. Abscess of the heart wall may succeed the lodgment of an infected embolus. Fatal embolism in organs other than the heart may occur from the intracardiac thrombi which attend infarction. If fibrous tissue replace the necrotic zone of myomalacia, dilatation locally with aneurysm formation may result. As in the experiments of Miller and Matthews<sup>8</sup> myocardial insufficiency may supervene at a more or less remote period and in such instances the final decline is rapid. After a series of anginal attacks status anginosus may determine the exitus. Peculiarly the painful seizures may completely disappear on the development of myocardial weakness. White<sup>39</sup> reported a group of sixty-two cases of coronary thrombosis with an average duration of life of almost two years after the attack. One-half of this group were still alive at the time of this report, further increasing the expectancy of life after coronary thrombosis.

As to treatment, opinions differ widely on the advisability of exhibiting digitalis. In general it should be reserved to meet the obvious indications of decompensation. Caffein and camphor have been recommended in the early cardiac depression. Their usefulness is doubtful. Epinephrin may be used in the circulatory collapse of coronary thrombosis. The nitrites are totally in-

effectual in relieving the pain. Leeching may prove beneficial in this relation. Morphine, although frequently without influence on the pain of coronary thrombosis, should be given in maximal doses. Its central nervous effect may be very useful. In the same connection the bromides and other mild sedatives are indicated for the continued care of the patient after coronary occlusion.

The after-care of the surviving cases of coronary thrombosis demands especial attention. The diet should be bland and easily assimilable. Small meals more frequently are preferable to the usual routine. Overdistention of the stomach must be avoided. Attention should be directed to the maintenance of the normal bowel function. Bed rest must be enjoined for at least six weeks. Thereafter physical effort must be resumed by easy stages, avoiding sudden circulatory loads and fatigue. Breathlessness and palpitation are relatively safe criteria of the limits of exertion. The blood pressure observations will further safeguard this regimen of physical rehabilitation. As Thayer<sup>40</sup> has pointed out in the discussion of the management of angina pectoris, the patient must be taken fully into the confidence of his physician, who will point out that his program of training differs from that of the athlete only in degree. The family must especially be partners in the care of the patient. Their undue solicitude may render him totally unhappy and uncomfortable; yet a thoroughgoing understanding and a coöperative interest on their part are essential to the proper management of the patient.

Thayer's analysis<sup>40</sup> of the outlook in the angina pectoris may be applied with little reservation to coronary thrombosis. "Angina may be a cruel and a painful malady leading to hopeless invalidism and long pre-mortal suffering. But often with proper treatment the patient may have years of usefulness and happiness in a life to which the excesses of activity alone are denied. The attacks, though distressing, may often be quickly relieved, and, in the end, the patient may pass from the turmoil of life to the peace of that which we call death in the twinkling of an eye, without a pang, without a movement, without a care."

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## THE HEART IN INFECTIOUS DISEASES: AN ELECTRO-CARDIOGRAPHIC STUDY\*

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**D**URING and following the various acute infectious diseases evidence may develop of a disturbance in the circulation. Almost any severe infection may be interrupted by an acute collapse with precordial pain, vomiting, apathy and pallor, changes in the rate and rhythm of the pulse and a marked drop of blood pressure. Also in convalescence a shock-like collapse may occur, most often in diphtheria, but also in other infections. More often following the various infectious diseases, the patient may develop such symptoms as fatigue, dyspnea on exertion, palpitation, dizziness and at times syncope.

The deranged circulation associated with infections has been the subject of considerable study, chiefly along two lines of investigation, (1) by physiological experiments, and (2) by postmortem examinations. The conclusions arrived at by these methods are somewhat contradictory.

In 1899 Romberg and his associates, using the physiological approach to the problem, inoculated rabbits with pneumococci, diphtheria and pyocyanous bacilli. They concluded that death was due to a failure of the vasomotor control of the arteries which allowed the blood pressure to fall, and that the heart muscle suffered secondarily from the lack of nutrition. These conclusions were based on the fact that the methods which ordinarily induce vasomotor reactions were ineffectual in the toxic animals. This conception of a vasomotor paralysis in infections was accepted by many for a considerable time. MacCallum, in 1914, with different experimental procedures and using a diphtheria toxin, arrived at a similar conclusion. Although he conceded that a myocardial weakness might play a part, he believed that the most important factor was a vasomotor paralysis.

Pathologists, on the other hand, studying the heart after toxic conditions, point to the degenerative changes which may be present in the

myocardium and they insist that this type of heart muscle can play an essential part in a circulatory insufficiency. One may object to a final conclusion from this kind of evidence because of the well known difficulty in correlating myocardial function with structural change. It appears very probable that the contradictory conclusions arrived at by these two methods of investigation can be explained on the basis that bacterial toxins produce a poisoning of both the heart and vasomotor apparatus. The degree with which one or the other is affected may depend on the kind of toxin, on the dosage, rate of absorption, variations in resistance and certain unknown factors. MacCallum, for instance, injected a massive dose of diphtheria toxin into his animals and showed the presence of an impaired vasomotor center. Edmunds, recently studying the effects of digitalis in diphtheria-poisoned dogs, administered the toxin at a much lower rate and found that cardiac stimulants were effective in raising the blood pressure. The essential point in any given case is to determine which of these mechanisms is operating, and it is of special importance to know whether the myocardium is involved. This is well expressed by Allbutt in the following paragraph: "In infections we know that the heart is concerned in three ways: in some of them it is directly attacked; in others it seems to suffer rather from a general depreciation in common with other parts and tissues, an impairment due apparently to pyrexia or to some diffuse effect of the specific poison; in others, again, from a dissociation from its peripheral complement, from a loss of tone in the 'peripheral heart,' so that it beats the air in vain. Now, for these different conditions, have we any crucial symptoms by which to distinguish them? Have we in a particular case any criterion by which, in an infectious disease for instance, we can discriminate myocardial lesion, myocardial sympathy with a more general and temporary debility, and slackening of the peripheral circulation?" Allbutt goes on further to evaluate the various signs and symptoms which may occur, and con-

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cludes that there are none which will definitely indicate whether or not the myocardium is involved in the general process. The present study is an attempt to determine whether the string galvanometer offers any aid in the detection of myocardial involvement in infections.

#### ELECTROCARDIOGRAPHIC EVIDENCE OF MYOCARDIAL DAMAGE

The string galvanometer first used almost entirely in the study of cardiac irregularities has more recently been applied to the detection of myocardial damage. Certain alterations of the ventricular portion of the complex can be experimentally produced by injury to the myocardium in various ways. For example, interference with the blood supply of the heart by ligating branches of the left coronary artery or by experimental coronary embolism, will invert the normally upright T wave. The introduction into animals of substances which injure the myocardium, such as spartein sulphate and adrenalin, is followed by T inversion.

In clinical conditions inversion of the T wave in leads I and II is usually found associated with serious cardiac disease. In hypertension heart where the myocardium is reduced in function due to chronic fatigue, T negativity is common. In coronary disease where large patches of fibrosis may occur, T inversion is also very frequent. The serious import of the presence of this electrocardiographic sign is emphasized in the statistical studies of Willius. He showed that approximately 60 per cent died a cardiac death within a year. This indicates that T inversion may be regarded as evidence of severe myocardial injury.

Another evidence of myocardial injury which is less frequently seen clinically is widening and notching of the QRS portion of the ventricular complex. This is also usually noted in association with serious cardiac pathology. An additional electrocardiographic finding which is also observed is prolongation of auriculo-ventricular conduction. This is found at times in apparently normal hearts and is undoubtedly an evidence of injury of a lesser degree. The following consists of an electrocardiographic study in various infectious diseases, attention being directed to these graphic evidences of myocardial injury.

*Observations in Diphtheria.*—The first studies were carried out in diphtheria, since the general

impression is that of all infectious diseases this is the one which most notably affects the heart. Smith, McCulloch and Marvin have carried out electrocardiographic studies during the acute stages of diphtheria. They show that marked abnormalities are almost constant in the severe cases, indicating disturbances in the auriculo-ventricular conduction. The present observations were carried out in convalescence, since circulatory collapse and death may occur without warning during this period. Fifteen cases were studied, for the most part in the third week of the illness. All the patients had recovered from the initial throat infection and had negative throat cultures for diphtheria bacilli. There were no distinct cardiac symptoms with the exception of palpitation on slight exertion, such as change of position. There were no physical signs which could be interpreted as definite indications of myocardial involvement. Of the fifteen cases, seven showed changes in the electrocardiogram indicating pathology. This consisted of inversion of the T in one or more significant leads. Aside from this finding there were no important electrocardiographic abnormalities with the exception of extrasystoles in two cases. The T inversion was very definite and was present in lead I in one instance and leads I and II in another, in leads II and III in three cases and in the remaining two it was present in all leads. In two of the cases sudden death followed within a week after the records were taken. In the remaining five the patients were observed over a long period when the T became upright, usually at about two months after the onset of the illness. Two of the patients were under constant hospital observation during the entire period in which these changes were taking place, electrocardiogram tracings being made every third day. The return to normal was a gradual one, the T wave becoming first less negative, then isoelectric, and finally upright. The following are two illustrative cases:

*Case 1.*—M. B., aged 20, entered the contagious hospital October 30, 1925. She was very ill for about four days, but gradually improved. On the seventh day she had an attack of precordial pain, vomiting, and a slow pulse was noted. A heart block was suspected at this time, but unfortunately an electrocardiogram was not obtained. She cleared up under various stimulants. Fifteen days after admission her throat cultures were negative and her progress had been entirely satisfactory. She was allowed to sit up in bed but her pulse rate increased on even such slight exertion. Ex-

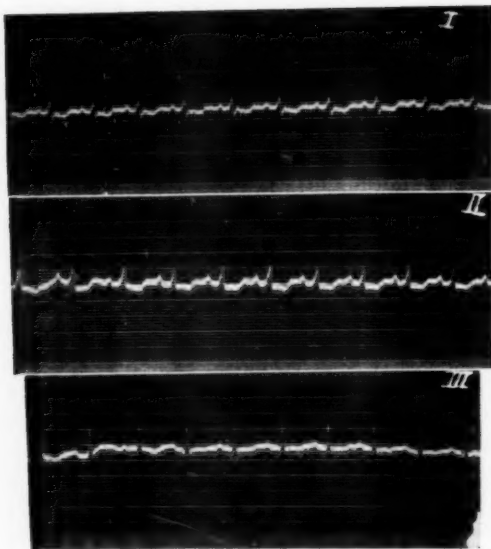


Fig. 1. Case I. Leads I, II and III showing inversion of T in all leads four weeks after onset of diphtheria. Patient died suddenly a week after this record was taken.

amination one week later showed a possible slight dilatation, a gallop rhythm and an occasional extra systole. At this time an electrocardiogram (Fig. 1) showed inversion of the T in all leads with low voltage. Another record a few days later showed the same changes. Six days after this second record, while sitting up in bed and reaching for a pitcher of water, she gasped, fell back and died within a few minutes. This illustrates a case in which myocardial involvement could not have been diagnosed definitely without the electrocardiogram in spite of the fact that a condition of sufficient severity to cause death was present.

*Case 2.*—M. W., aged 24, developed a sort throat November 14, 1926, and was admitted two days later to the contagious hospital where a diagnosis of diphtheria was made, and antitoxin was administered. Fifteen days after admission practically all of the symptoms had disappeared and an electrocardiogram showed inversion of the T in leads II and III (Fig. 2). Repeated electrocardiograms were taken several times a week, showing no change until January 7, 1927, seven weeks after admission, when the inverted T was replaced by a flat iso-electric T. This flat T persisted until January 21, when an electrocardiogram showed low but upright T waves. Since that day all the records have shown definitely positive T waves. The patient was kept at rest in bed and was not allowed to sit up until the T wave became upright. She was seen again six and one-half months after the onset of her illness and felt well aside from some weakness. The examination of the heart was negative and the electrocardiogram was entirely normal.

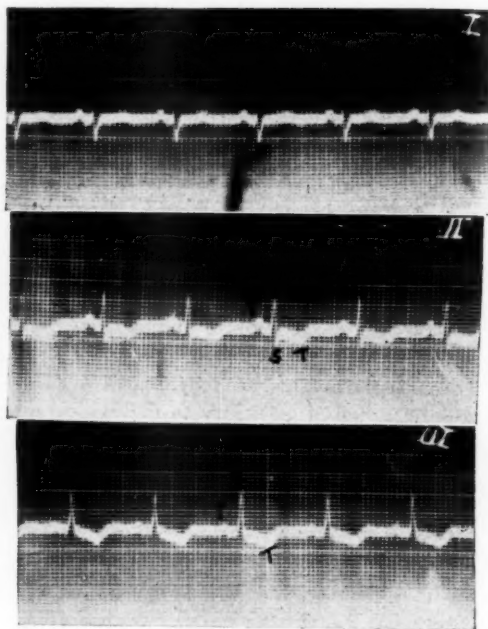


Fig. 2. Case II. Leads I, II and III showing inversion of T in leads II and III in third week of diphtheria.

A study was also made of the effects of injection of diphtheria toxin on the electrocardiogram in cats. After a control record was taken, a sublethal dose of diphtheria toxin injected subcutaneously, subsequent records were taken every second day. In ten experiments electrocardiographic changes were noted in eight, the alterations resembling those noted in the diphtheria patients. There was inversion of the T wave in one or more leads in each of the eight animals. In addition to the T wave inversion, widening of the QRS portion of the complex was also present in two cases. In two of the animals living for ten days following the injection there was a definite tendency for return to the upright T. Figures 4 and 5 are records during one of the experiments. From the above observations in diphtheria patients and animals with diphtheria toxemia, one may conclude that alterations in the electrocardiogram with inversion of the T may be used as evidence of damage to the myocardium by a bacterial toxin.

*Observations in Other Infections.*—A group of thirty cases of various infectious diseases was studied for comparison, consisting chiefly of rheumatic fever, pneumonia and scarlet fever.

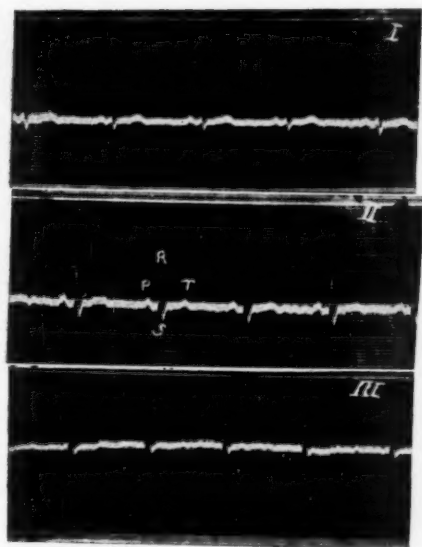


Fig. 3. Case II. Leads I, II and III showing return to upright T, seven weeks after the onset.

This series is too small to permit of anything but some general conclusions. The number of cases of each disease does not warrant a statistical analysis for each infection. The group as a whole, however, serves fairly satisfactorily for comparison, as the severity of the infections was about the same. T wave inversion was present in four cases, an incidence of 13 per cent as compared with 47 per cent in the diphtheria group. Of the four instances of T inversion three were associated with rheumatic fever and one with pneumonia. All three rheumatic fever cases showed evidences of acute pericardial involvement. This is of interest since it is in the cases showing acute pericarditis that a pancarditis with definite myocardial involvement is to be expected. In two instances where subsequent records were possible the T inversion had disappeared at a later period. One case showing  $T_1$  inversion in the acute attack was examined six years later, when the physical examination of the heart and the electrocardiogram were normal. The only other case of T inversion in this group occurred following pneumonia. The patient was suffering from cough and dyspnea three weeks after the onset and the x-ray examination showed evidence of delayed resolution in the lungs and some cardiac enlargement.

The electrocardiographic finding which was

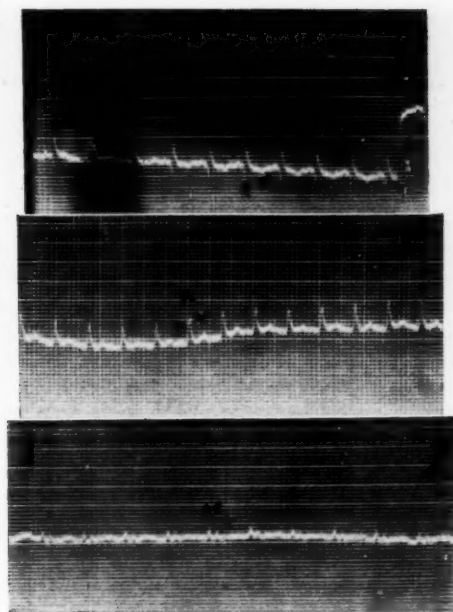


Fig. 4. Electrocardiogram of a cat, before injection of diphtheria toxin. Note the flat T in lead I and positive T in leads II and III.

most frequent in this group was prolongation of the P-R interval, indicating delay in auriculo-ventricular conduction. This was present most often in the rheumatic fever cases but also occurred in pneumonia. This finding has been pointed out, especially in rheumatic fever, by Cohn and Swift, Rothschild and his associates and others. Hamburger has also observed P-R prolongation following influenza. In the present group it was noticed frequently in patients showing very mild evidence of toxemia. More than one-half of the cases in this series had normal electrocardiograms. Many of those showing a normal electrocardiogram presented circulatory symptoms and these were undoubtedly on a vasomotor basis. The incidence of myocardial involvement as indicated by the electrocardiograph during and following various infectious diseases can be arrived at only by a study of a much larger series of cases, a study which is at present in progress.

#### CONCLUSIONS

1. Electrocardiograms show evidence of myocardial involvement during and following acute infectious diseases.
2. T wave inversion is seen most frequently

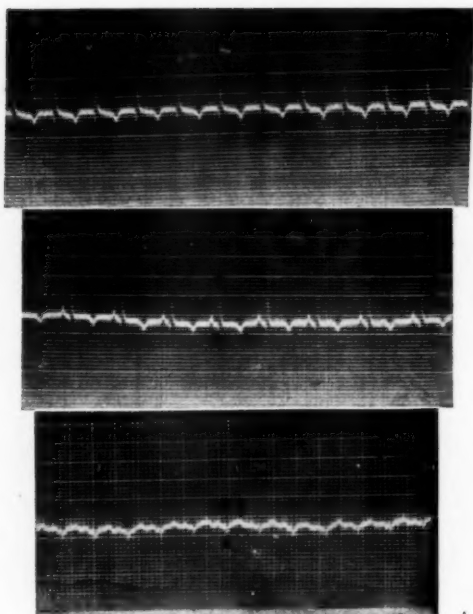


Fig. 5. Electrocardiogram of same cat as Fig. 4, 48 hours after injection of diphtheria toxin. Note deep inversion of T in leads I and II.

following diphtheria and indicates severe myocardial injury.

3. There is a later return to normal, indicating that the toxic effect on the heart muscle is a transient one.

4. In other infections, T inversion is found less often, while prolongation of the auriculo-ventricular conduction is a more frequent electrocardiographic abnormality.

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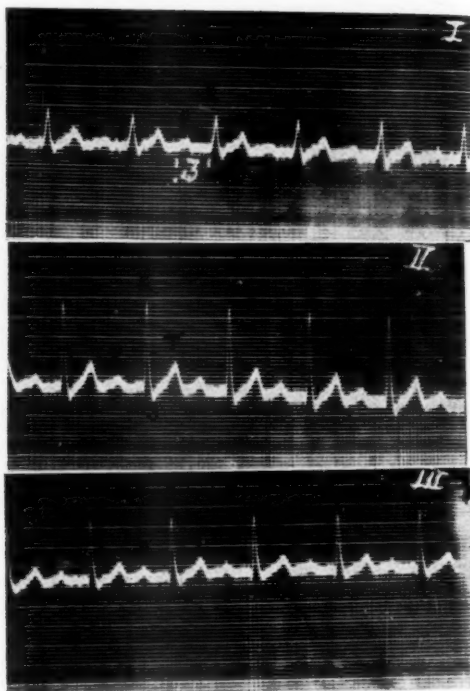


Fig. 6. Leads I, II and III from a case of rheumatic fever during convalescence. The P-R interval is .3 second (maximum normal is .2 second). This indicates delayed auriculo-ventricular conduction and is evidence of myocardial involvement.

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## CALCIUM THERAPY IN FUNCTIONAL NERVOUS DISORDERS\*

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DISEASES of the nervous system may be broadly differentiated as the organic, in which the disease symptoms are produced by a clearly demonstrable anatomical lesion, and the functional, in which no disturbance of anatomy is evident. This division of nervous diseases is by no means sharply defined. Bodily disturbances which we are prone to designate as functional, after a lapse of time often prove to be associated with anatomical changes; and frequently it is extremely difficult if not impossible to interpret all of the presenting symptoms and signs in the light of the existing pathological anatomy. The recent advances in physiology and the extension of physiological researches into the field of the pathological have demonstrated that anatomical disturbances in the organism may often be preceded by abnormal physiological processes. A consideration of etiology from the viewpoint of a disordered cellular physiology, molecular or ionic, may be of value in determining the causation of some of the so-called functional disorders. It is especially in this class of nervous disorders that the etiology has remained obscure, the treatment empirical and bizarre, and the prognosis discouraging.

The neurotic patient is with us always; not the same patient to be sure, because he soon tires of our rather ineffective therapeutics and travels to more distant fields where the grass appears more green and the prospects for relief of his varied complaints more hopeful. The train of symptoms presented by these patients we have memorized from hearing them repeatedly: nervousness, excitability, easy fatigue, apprehension, frequent headaches, perhaps insomnia, usually accompanied by minor symptoms referable to any of the various organs. All gradations of these symptoms present themselves, their severity ranging from normal mental health on the one hand to outspoken mental disease. All or some of the presenting symptoms may be the expression of early organic disease such as larval hyperthyroidism, incipient tuberculosis, chronic sepsis of periapical, tonsillar or para-nasal sinus origin, Addison's disease, diabetes, uremia, or the

early stages of organic disease of the central nervous system. These conditions must first be excluded by careful general physical examination with all the laboratory aids at our command before we can arrive at a diagnosis of a functional nervous disorder. In this last condition gross anatomical change is predominantly lacking and in the neuroses the changes in the cells, if such exist, are so slight that they are not demonstrable by the means at present at our disposal. Having excluded the presence of organic disease, how may we explain the behavior of these individuals?

I shall not attempt in such a short discussion of this subject to enumerate any of the theories explaining the causation and development of the functional nervous disorders. Suffice it to say that they are many in number, widely separated in their nature, and no one theory has been universally accepted. In a consideration of the etiology of the functional nervous disorders a study of the normal irritability of the living cell and the changes produced in that cell by chemical alterations of its environment may give us some insight into these conditions in which the irritability of the organism as a whole is so profoundly disturbed.

The normal cell irritability is dependent, among other factors, upon a balance of certain ions in the vital fluids. An increase of sodium, potassium or hydroxyl ions, or a decrease of calcium, magnesium or hydrogen ions leads to a heightened irritability of living tissue. Any disruption of the normal balance of these ions exerts a profound influence on cellular and animal behavior. The hyperexcitability of the neuromuscular apparatus as evidenced by tetany after feeding or injecting large doses of sodium or potassium phosphate or of sodium bicarbonate or carbonate, demonstrates easily the effect of these ions upon general cellular irritability. A lowering of the serum calcium such as is encountered in parathyroid deficiency, where the calcium content may fall as low as 4 mg. per 100 c.c., has an effect very similar to that produced by elevating the sodium or potassium concentration. The more recent use of solutions of the magnesium salts in the control of the convulsions of eclampsia gives us an excellent illus-

\*Read before the annual meeting of the Minnesota State Medical Association, Duluth, Minnesota, June 30 to July 2, 1927.

tration of the effect of the magnesium ion in depressing nervous irritability.

The beneficial effect of calcium feeding or injection in conditions where the serum calcium is lowered, has been utilized by pediatricists in many of the tetanies of infancy and childhood. In rickets with tetany and in most of the other infantile tetanies the serum calcium is decreased, frequently to 5 or 6 mg. per 100 c.c. The sodium and magnesium serum concentrations appear to remain normal, while the potassium ions may be slightly increased. In these conditions the administration of calcium or magnesium salts has proved temporarily beneficial; or a similar effect may be accomplished by producing a mild artificial acidosis by feeding hydrochloric acid milk or ammonium chloride. Serum calcium levels may also be raised indirectly by feeding cod liver oil or by exposure of the patient to ultraviolet radiation. In other conditions associated with low serum calcium values, the level of calcium may be raised by injections of the lately discovered parathyroid hormone.

When calcium salts are administered orally or given intravenously, there is a transient elevation of the serum calcium level. Recent studies in calcium administration have shown that a single large dose of calcium lactate administered orally to normal dogs raises the blood calcium by 3 or 4 mg. per 100 c.c. for three or four hours. When similar doses are administered to parathyroidectomized dogs the serum calcium is raised above the danger point for a correspondingly short period. Other calcium salts appear to be equally effective, but when heavy doses of calcium chloride were administered, vomiting ensued. Continued excessive calcium administration to normal animals is followed by loss of tonus and later paralysis. Lemiére in 1922 reported a curious result of prolonged administration of calcium chloride to a healthy man on a salt-free diet. After a time the individual lost weight, and became depressed both physically and mentally. As the result of replacement of the calcium chloride with sodium chloride the man became unusually exhilarated and was "salt drunk" for two days. Moderate doses of calcium salts appear to be tolerated by the body almost indefinitely with no apparent adverse results.

On the other hand animal experiments in calcium starvation have shown some very interesting facts. Animals kept on a low calcium diet after a period of time become easily excitable,

nervous, restless and more apprehensive than the normal animal. The animal behavior is rapidly brought back to normal by calcium administration.

Because of the close similarity of the symptoms and behavior of animals during calcium starvation to some of the symptoms presented by patients suffering from the less severe functional nervous disorders, it seemed to me that the symptoms presented by these patients might be the expression of a disturbed kationic ratio with its resulting effect on general cellular irritability and more particularly of a lowered calcium retention; and that calcium feeding in this class of cases might show some interesting results. No determination of the serum calcium in these cases has been made, and it is probable that any variation which might be observed by the present methods for calcium determination would fall well within the fluctuation of the normal levels.

In all, eighteen patients have been placed on prolonged calcium administration lasting from three to six months. Each of these patients was first given a thorough general physical examination with careful laboratory studies to rule out any evidence of organic disease. They were kept as nearly as possible to their former mode of living and were placed on no other medication. Calcium was administered orally, each patient receiving the equivalent of 20 grains of calcium lactate four times daily. One patient was given calcium chloride intravenously but this was discontinued because the effect produced appeared to be no more beneficial than that produced by calcium feeding.

The results of treatment were quite uniform. Within twenty-four to forty-eight hours the patient experiences a feeling of mental well-being, the nervousness and apprehension disappear, and the feeling of fatigue so commonly complained of is replaced by a sensation of physical fitness. In most of these patients the appetite was improved, and they were able to sleep better than they had for a long time. Four of these patients who had suffered from frequent dull occipital headaches stated that they had no recurrence while on calcium medication. This observation is quite in accord with those of Riggs in the treatment of migraine with calcium feedings. In one patient the blood pressure which on numerous occasions over a period of two years had remained about 98 mm. Hg. systolic for no apparent reason, on calcium feeding rose

in the course of eight days to 122 mm. Hg. and has remained at that level even though calcium administration has been discontinued.

The effect of ultra-violet light, cod liver oil or parathyroid feeding which produce an elevation of serum calcium, has not been studied in this series of cases. Every effort has been made to observe the results of calcium administration uninterfered with by other factors. While a similar effect would undoubtedly be produced by ultra-violet radiation, this phase was not investigated.

A detailed report of two of the cases which are fairly typical of this group follows:

*Case 1.*—The patient, a married woman aged 41, complained of not feeling well for a number of years. Her present symptoms are faintness, numbness of the hands and feet, frequent dull headaches occurring at any hour of the day unaccompanied by vomiting, and a general feeling of exhaustion. She has always been emotionally unstable and moderate exertion has been followed usually by a period of high nervous excitation, insomnia, faintness and apprehension, resulting in general exhaustion. She has consulted numerous physicians and clinics and has always been told that she has no organic disorder. The usual treatment of enforced rest periods, high caloric feeding, and tonic medication has been prescribed repeatedly. In 1922 she was ordered to bed for four weeks because of a "nervous breakdown" from which she has never recovered.

Physical examination showed a patient slightly above average weight, with flabby muscular development, irritable, and restless. The pulse was 85 and soft. Otherwise the physical examination was negative. Blood Wassermann was negative, blood and urine normal. Hemoglobin 85 per cent, blood pressure 105/72. Roentgenograms of the teeth and chest were negative. The basal metabolic rate with the Benedict-Roth apparatus was +6 and +3. The pupillary and other reflexes were normal.

This patient was placed on calcium medication the equivalent of 20 grains of calcium lactate four times daily. After three days she reported that she had not felt so well in years. This medication was continued for six months, during which time she attended her household and social duties, which were heavy, with no inconvenience. At the end of six months all calcium medication was discontinued. She reports at present that she is still physically and mentally well, but that occasionally following an unusual emotional or mental strain she voluntarily returns to calcium medication with complete relief.

*Case 2.*—This patient, aged 18, has always been a nervous and excitable girl. She was by nature a reticent individual and avoided company or crowds because of resulting mental excitation. On exertion she was easily exhausted and had frequent occipital headaches. Since the age of twelve years she has complained of indefinite pains in various parts of the body, occurring most frequently in the legs and ankles. This

condition was diagnosed as rheumatic in 1923 and tonsillectomy was performed with no relief. One year later three unerupted last molars were removed for a similar reason but with no relief. At about the age of fourteen she developed a symmetrical enlargement of the thyroid gland which has persisted. Menstruation began at fourteen years of age, is of the twenty-eight day type, lasting three days with no unusual discomfort. In 1925 she entered a metropolitan hospital for nurse's training but was advised to discontinue this work four months later because of arthritis of the ankles and a toxic goiter. She was later seen by one of the larger clinics where her metabolic rate was found to be normal. She was then advised that she had no organic disorder and was placed on the usual treatment of rest, fresh air and sedatives. When first seen by me she was very much discouraged with the general outlook.

Physical examination revealed a girl of good physique but of sallow complexion, very nervous and easily excited. Pulse 92, temperature 98.6. Blood Wassermann was negative, blood and urine normal. General physical examination failed to reveal any evidence of organic disease except a symmetrical enlargement of the thyroid and a heart which was easily accelerated by excitement. Roentgenograms of the teeth, chest and ankles were negative. The basal metabolic rate as determined by the Benedict-Roth apparatus was +8, +4, and +7 respectively.

This patient was placed on calcium medication the equivalent of 20 grains of calcium lactate four times daily. One week later her mother informed me that the general condition of the girl was changed completely. When seen in the office one month later a marked improvement in her mental state was readily apparent. She stated that the pains in the legs and ankles and the headaches had disappeared during the first week of treatment and have not recurred. Her appetite and complexion were improved. She was kept on calcium medication for six months, at the end of which time the dosage was reduced to the equivalent of 20 grains of calcium lactate every morning and evening. She has remained well to date and contemplates resuming her nursing training in the fall.

From this series of cases it appears that there may be a more or less direct relationship between the functional nervous disorders and calcium metabolism. No claim is made for calcium medication as a panacea in the neuroses, and it is doubtful that calcium therapy in the more severe forms of the neurasthenias and psychasthenias will produce as encouraging results. We cannot expect a biologically inferior organism or one which has never been able to make any adjustment to its environment to be brought into equilibrium with his fellows so easily. On the other hand, in the milder neuroses these cases demonstrate, I believe, rather clearly that a serious consideration of the calcium metabolism may be of definite value.

# THE TREATMENT OF CEREBRAL PARALYSES AND SPASTIC PARAPLEGIAS\*

STUDIES IN RECONSTRUCTIVE SURGERY

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**R**ECONSTRUCTIVE surgery is the application of usual surgical procedures combined with certain adjuncts referred to as physiotherapy (massage, muscle training exercise, gymnastics, mechanotherapy, electrotherapy and hydrotherapy) and occupational therapy (bedside, ward and workshop occupations) used for diversional or purposeful objects, and the personal supervision of the application of all these adjuncts by the surgeon until the functional restoration of his patient is assured as far as is humanly possible.

Reconstructive methods have made rapid advancement since the war period, due to the wide dissemination of knowledge to both the profession and the public at that time, concerning the possibilities of functional restoration of chronically disabled individuals. Seldom is an address made in any city, town or village on the subject of Rehabilitation of the Disabled that is not followed by one or more consultations with a physician who presents some permanently disabled patient, usually an impoverished individual, seeking the means of a possible functional restoration. Too often the individual has been disabled for years, this is the cause of his impoverishment, and both patient and physician have long since become pathetically satisfied with the hopelessness of his condition. Even when reconstructive surgery can offer no improvement, yet a spark of hope has been engendered which can be taken advantage of by pointing out the possibilities of utilizing his remaining members or his brain to greater purpose for the improvement of his social status.

This is rehabilitation. The reconstructive surgeon to be successful must know rehabilitation laws and methods. It is surprising, to those who have not followed this work, the increasing number of the above type of patients who are being rehabilitated throughout the country.

We have been impressed, especially in the

smaller communities, with the number of paralytic cases among children and young adults who have gone untreated for years. We have found cases of cerebral paralyses, with paraplegias, who have never walked, one of these as old as twenty-one years, and two who had reached the ages of fourteen, in addition to others ranging from infancy to the age of twelve, who were still being carried in their mothers' arms. Cases of monoplegia, hemiplegia, diplegia from congenital or acquired causes, of infantile paralysis and of epilepsy make up a great number of the disability conditions presented for reconstructive methods. It is safe to say that in almost every community of the land there is at least one individual thus afflicted and too often no effort at improvement is being made in his behalf.

This paper will present no new measures of orthopedic or brain surgery. It will throw no scientific light on the cause of these obscure pathological conditions. It will, however, strive logically to show the large number of these cases still untreated; the great value of a searching examination of all such individuals in order to find the few that can be treated by a definite surgical procedure, and to emphasize the importance of a well defined program of physical and mental education with a view of giving a large majority of these patients a chance for their proper status in the economic world.

During the last ten years the authors have had a large number of instances where the combined use of surgery and physiotherapy have given some excellent results viewed in comparison to the pitiable condition of these patients before treatment was instituted.

The following case reports illustrate the nature of the disability and the forms of treatment adopted:

*Case 1.*—R. W., aged 13, suffered a serious illness when six months of age. He had been a well developed, normal baby, kicking his legs about as well as any baby of that age. The illness was called inflammation of the bowels. Following the illness, however, the

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mother noticed that both legs were paralyzed. Ralph was unable to move his lower extremities as he grew older and therefore his brothers made him a little wagon in which he could ride—also a chair with wheels which he could use in the house. As he grew older he sat in his chair or wagon with his thighs flexed on the abdomen and his lower legs drawn up under the thighs. Naturally, in time the lower extremities became fixed in these positions. The boy finished grade school, sitting in his little wagon, which was taken into the school house. The Kiwanis Club of Muncie, Ind., then became interested in the case and arranged to take the boy in some member's auto to high school every morning, and another member would drive him home in the evening. The principal arranged a desk on wheels and in this way Ralph was able to continue his education.

At the end of his freshman year he was sent to St. Luke's Hospital in Chicago to see if the legs could be straightened. One of the authors (Mock) performed a Soutter's operation on each thigh, lowering the anterior-superior spine of the ilium with muscle and fascia attachments intact, thereby enabling the straightening of the flexed thighs. The contracted hamstring muscles and the tense fascia in each popliteal space were then severed and the flexed, deformed lower extremities were thereby straightened. Plaster of Paris cast from lower abdomen to toes was then applied in order to maintain the corrected position. At the end of six weeks the casts were changed to splints in order to allow massage and a certain amount of muscle training exercise. Following the removal of the splints at the end of ten weeks, physical therapy became the chief form of treatment. Massage, hydrotherapy and muscle training exercises were used and by the end of three months this boy was being taught the use of crutches. Muscle training exercises were continued after he returned home. A suitable brace was made to hold the paralyzed lower extremities in the corrected position and to enable him to bear some weight on his legs.

This boy graduated from high school this year. He has been working evenings and Saturdays the last year as a salesman and has driven his own Ford to and from school and in his work. He has grown in stature so that today his original crutches made three years ago now reach only to the hand grips of his present crutches.

A case almost identical to the above was referred by Dr. E. G. Wilson, of Kankakee, Ill.

*Case 2.*—A boy of ten was carried into Dr. Mock's clinic by his mother. He had never walked. The condition seemed to be one of spastic paraplegia without any marked mental disturbances. A Soutter operation was performed and the tendons in the popliteal space and the Achilles tendons were all lengthened, thereby overcoming the deformities. First, plaster of Paris casts followed by suitable braces were used. A prolonged course of massage, muscle training exercises and physical therapy followed the surgical procedure and resulted in enabling this boy to go about on

crutches and carry on much the same as a normal boy would in his school work and ordinary duties.

*Case 3.*—D. R., is a male, American, twenty-five years old with a spastic paraplegia, the oldest of thirteen children, five now living. His father was killed seventeen years ago. Three years ago the mother became paralyzed. This boy had never worked because of the halt in his walk and his defective speech; he had never been given a chance. The Service League referred him to Dr. N. C. Gilbert, who recommended work and speech training. The boy worked for three months in occupational therapy rug weaving, and there is at least 30 per cent improvement in his hands, and his speech is greatly improved. His present earning capacity is \$12.00 per week.

*Case 4.*—F. D., female, aged 15, fell from a third story window when eight months of age. She sustained a serious skull fracture which was treated non-surgically. As a result she had a complete right sided hemiplegia. As the years went by, the right arm and leg developed but less so than the left. The right arm showed a definite spasticity at times and was held in a flexed, pronated position. Several operations had been performed on the tendons of the right foot to correct the valgus position. At the age of thirteen, she had an attack resembling a Jacksonian epilepsy which began in the foot and extended up the leg. These attacks increased in frequency and severity and at the age of fifteen were also involving the arm. There was no definite loss of consciousness. The attacks always occurred at night except once when she fell in an attack at school. In January, 1923, the patient was referred to Dr. Mock by Dr. Loren Dewey of Okanogan, Washington. An x-ray examination revealed a fragment of bone broken completely from the inner plate of the skull and lying in the brain cortex about two inches from the surface of the brain. The case was operated and the fragment of bone,  $2 \times 1 \times .25$  cm., lying in a small cystic cavity just anterior to the left fissure of Rolando, was removed. Patient made an excellent recovery. Patient was referred three months later to Dr. Coulter for physiotherapy. For two years she has had muscle re-education along the lines to be described in detail later, and her high school has assisted and coöperated in giving her swimming lessons. This patient, who is now nineteen years of age, has not had an attack of Jacksonian epilepsy since the operation, except an occasional slight twitching of the foot the first year after operation. The spasticity has left her arm and she walks much better than previously. By the continued muscle training exercises and development of her leg muscles she has been able to discard the brace which she has been forced to wear all her life.

*Case 5.*—F. B., male, aged 19, was employed in a printing establishment. In April, 1925, while leaning over he was struck between the shoulders by a heavy roll of paper which fell from a height. He was doubled over, giving a jackknife flexion to the back. He was brought immediately to St. Luke's Hospital and examined by Dr. Mock and Dr. Geo. Hall, the neurolo-

gist. Complete paralysis of both lower extremities was present with absence of reflexes and sensation.

X-ray examination showed a fracture of the lamina of the first lumbar, a marked compression fracture of the body of the second lumbar, fractures of both transverse processes of the second lumbar and a backward displacement of the second lumbar vertebra upon the first. An immediate laminectomy was deemed advisable, and was performed within three hours after the accident. The following condition was found:

The left lamina of the first lumbar vertebra was splintered and crushed down upon the cord. There was a small splinter of bone transfixing the cord in the left lateral tract. The second lumbar vertebra was broken completely through the body and the body was shoved backward so as to cause pressure upon the cord. The laminae of the first and second lumbar vertebrae were removed and whereas the cord, on first being exposed, was found not to pulsate, pulsation gradually returned in the cord.

The foot drop so prone to occur in this type of paralysis was prevented by immediate splinting. All other deformities were counteracted by splinting. Massage and muscle training exercises were started early. The patient was given bedside occupations and five months later was able to go to the occupational therapy workshops, where he learned to work the pedals of a jig saw and to pedal a stationary bicycle. On discharge from the hospital he was referred to the physiotherapy laboratory, where he still goes for treatment. This treatment follows the principles described later in this paper.

He is now able to walk without a cane although he carries a cane to aid in the rapidity of his walk. He is going to business college, an opportunity offered to him by the State Vocational Rehabilitation Department. He will always have signs of some paralysis in his lower extremities but he is an outstanding example of the value of the combined surgical and physiotherapy treatment.

In the physical treatment of these cases of spastic paralysis there are several points to be emphasized. The first and most important is that physiotherapy should be started as early as possible, and this means as soon as the shock of the injury has subsided and the general condition of the patient will permit. This will avoid the necessity of correcting many deformities.

The aid of the patient and his family must be enlisted and they must thoroughly understand that the important part of the treatment is the patient's coöperation to reestablish communication between the damaged brain or spinal cord and the healthy muscles. They must be taught early to keep the helpless limb from assuming a fixed position, and the physician must keep the limb from developing arthritic and muscular contractures.

The positions naturally developed in a spastic limb must be remembered so as to prevent them by frequent changing to the opposite positions, and by the use of pillows, sand bags, exercises and the judicious use of splints. The spastic muscles of the arm are commonly the adductors and internal rotators of the shoulder, the flexors of the elbow, the pronators of the forearm, and the flexors of the wrist, fingers and thumb; and in the leg the extensors, adductors and internal rotators of the hip, the extensors of the knee and the plantar flexors and invertors of the foot.

The leg muscles recover first, then the arm and last the muscles of the hand.

If splints are used in these cases remember that the main object is to establish motion and not simply to prevent contractures, so that the splints must be removed frequently and much harm can be done by oversplinting.

In our physical therapy clinic on the first visit of the cases the patient, a member of his family, the physician and the physiotherapy technician have a conference and the following points are carefully considered:

1. The patient and his family are instructed to have him make an effort to correctly move each joint about four times a day. If the joint only moves slightly the patient should be assisted through the full movement.

2. The patient must make a mental effort to move the joint while the physical movement is being carried out, so these movements should be performed seriously in a quiet room with only one member of the family present to assist.

3. As one joint recovers, the tendency to devote all the energy and time to this motion must be discouraged and an equal time given to trying with all joints.

4. Massage is useful to promote the flow of lymph and blood in the lymphatics and veins and thus remove the waste products, and also to maintain the muscle tone by stimulation of the arterioles. These have unstriated muscle in their walls and can be paralyzed by over-handling, just as the intestines can. Therefore only the most gentle massage must be given.

5. Sometimes active movements of muscles can be started by electrical muscle stimulation, but apart from this electricity is not often indicated as it increases reflex spasm and the nutrition and functional activity of the muscles are not affected as in peripheral nerve lesions.

6. Forcible stretching of the spastic muscles is contraindicated because it increases the spasticity.

7. Avoid bad habits in walking. The patient should constantly be instructed not to move his leg by circumduction at the hip, but by flexion of the thigh and the knee.

8. In cerebral paralysis it must be remembered that there is an inability to perform certain movements and not a paralysis of individual muscles.

9. Reëducation of muscles is a combination of muscle rest and muscle action. Too much work causes fatigue, which is harmful, so the work must be accurately prescribed, trying to increase the amount each day.

10. Coördination exercises should be started early, and coördination of the proximal joints should be secured before the distal are tried.

11. Patients must be taught not to keep their attention entirely on the paralyzed limb. Therefore they should be taught to do their exercises with both limbs at the same time.

*Case 6.*—J. E. H., a male, aged 40, was referred by Dr. Vandeventer, Ishpeming, Mich., and Dr. Yates of Milwaukee, with a history that on May 14, 1926, he was struck on the left side of the head by a rock, suffering a skull fracture with immediate loss of speech and complete paralysis of the right side. He was operated immediately after the accident and two days later by Dr. Yates, Milwaukee, Wis., and there is a cranial defect of an area 2 inches in diameter of the left parietal. There was inability to void for ten days, but the bowels were not disturbed. Vision, hearing, taste and smell were not disturbed. He was unable to walk until July 1.

In this treatment the above points were first gone over. He and his wife stayed in Chicago for one week during the first month. Before his exercises were started, radiant heat was applied for about fifteen minutes to his leg, followed by gentle massage and stretching movements, to relieve the spasticity. He was then taught to walk, raising the knees and dorsally flexing the ankle and foot turned out. This was watched carefully. He was then taught to step over books of increasing thickness. After this he was again placed under the radiant heat over the arm and after fifteen minutes of this, gentle massage of the arm was given. He could not abduct his arm at the shoulder, so an overhead pulley was rigged up with a weight on it which helped him to do this and the weight was gradually decreased as he improved. He was taught to move one joint at a time correctly with the other muscles contracted. When he moved his elbow he was allowed at first to have his wrist and fingers flexed. Later when he moved the elbow, the forearm was held supinated and the wrist and fingers

moderately extended. One joint was first controlled, then two, and finally the whole arm. To follow one of the principles of using both limbs at once we used a broomstick exercise. At first the stick was grasped with both hands so the sound arm could assist and move the hands further apart as the arm progressed. Also at first the forearms were pronated, as this is the natural position for them, and later supinated. The exercise is to raise the arms above the head with elbows extended and elbow flexion and extension.

This man made three visits of about three days each the second month, two visits the third month, and one visit each in the fourth, fifth, sixth and seventh months. He is slowly progressing, the hand being, as usual, the last to recover.

Formal exercises in these cases have the advantage of isolating particular joints and allow for repeated exercises under controlled conditions for limited periods of time. The disadvantages are that the human body is more than a machine when voluntary movements are concerned and the formal repetition of a movement is not of maximum therapeutic value in increasing the amount of movement in the affected part or in making it of use as an integral part of a larger coördinated movement of which each movement must ultimately be an essential part. Therefore curative occupational therapy is based on the fact that the best remedial exercise is one that requires a series of voluntary movements such as are involved in the ordinary occupations. These movements have the advantage of being initiated by the patient and forming a necessary part of a larger and more complex series of co-ordinated movements. There is also an incentive in the purposive nature of the work that is absent in ordinary exercise. In these cases much can be accomplished by various forms of carpentry, and in this case sawing was used for elbow flexion and extension, and holding the board to be planed or sawed was used for extension and abduction of the thumb.

#### CONCLUSIONS

These few cases serve to illustrate that there are many self-pitying, dependent cripples who with the proper combination of surgery and physical therapy could be made into self-reliant, independent citizens.

The personal supervision of the surgeon and his coöperation with the physical therapy department until the functional restoration of his pa-

tient is assured as far as possible will prevent many disabilities.

In these spastic paralysis cases it is not the surgeon who cures the patient, he can only make the cure possible; nor the physiotherapist, he can

only direct the patient; but it is the mental effort of the patient, which results in a cure after proper surgery and proper physical therapy.  
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## EDITORIAL

### Advance in Thoracic Surgery

The interest in thoracic surgery in America began about twenty years ago. The impetus was the advent of apparatus for differential pressure. The specially built chamber for differential pressure, later supplanted by the intratracheal insufflation method, removed the great obstacle to successful surgery. Removal of tumors of the chest-wall involving the pleura, tumors of the lung and the mediastinum, and resection of the intrathoracic part of the esophagus for carcinoma have been done with success. The surgery of the heart has awakened new interest, thus valvotomy has been performed in case of mitral stenosis with improvement of the patient, cardiomyolysis for adherent pericardium has been performed and several cases of suppurative pericarditis have been cured by drainage.

Hippocrates treated empyema of the pleural cavity by incision and drainage and the same principle is in vogue at the present time. The

use of air-tight drainage in acute streptococcus empyema is a step forward. Conservatism in the treatment of abscess of the lung is the tendency of today, as the operative mortality in the acute stage is high. In a considerable number of cases the abscess breaks into a bronchus and heals by rest and postural drainage. Where thoracotomy for drainage is required this can more safely be done a few weeks after the acute onset, when the patient is in a better condition and the abscess is walled off; on the other hand the operation must not be postponed until the wall of the abscess has become fibrous and hard. A two-stage operation is performed if pleural adhesions have not formed. If an abscess of the lung breaks into the pleural cavity, drainage of the latter should be instituted as soon as possible. Such treatment was practiced by Hippocrates and it is in vogue today. In the treatment of bronchiectasis, various surgical measures have been tried. The ideal operation, by lobectomy, has at present a high mortality. The graded cauterization lobectomy, in a series of forty-five cases, has shown freedom from symptoms in 69 per cent. Another method, by which the diseased lobe is delivered, sutured to the musculature in the incision, allowing nature to destroy it by necrosis, is still on trial. Following the "graded extrapleural thoracoplasty," preceded by phrenicoexeresis, a number of cases have been reported improved and some have been entirely free from cough and sputum. Mediastinal infection and suppuration has received more attention of late years and a little more clarity from an anatomico-pathologic standpoint has been gained.

A number of cases successfully operated upon have been reported. The surgical treatment of pulmonary tuberculosis by paravertebral thoracoplasty, although adopted relatively late in this country, has rapidly gained in favor and has shown good results. Where complete collapse of a cavity has not been obtained, after the paravertebral thoracoplasty, apicolysis by transplanting fat or muscle to compress the lung, or further removal of ribs anteriorly have been tried. Progress has been made in thoracic surgery. More rapid progress may be expected with a closer coöperation between the internist, the surgeon, the radiologist and the endoscopist, as thereby earlier diagnosis will be made with better prospects of cure of the patient.

W. L.

### Superior National Forest

Those who believe in the necessity of recreation and those who love Nature, read on. Others need not. That physicians as a rule appreciate outdoor sport is indicated by the large number who not only spend their vacations in the wilds, fishing, hunting or canoeing, but also advise their patients to do the same.

Anyone who has visited the northeastern corner of our state knows what a beautiful part of the state it is. The rocky ground, rivers and lakes clear as crystal and the vegetation limited for the most part to spruce and pine, render this part of the state ideal for fish and game and particularly for man's relaxation. Notwithstanding the fact that the original pine of this region has long ago been cut, the second growth has rendered the country attractive in every way. The present generation can only speculate as to how this wild country must have appeared with its forest giants, the results of a century or a century and a half of growth. President Roosevelt realized the value of this wild region when he approved the establishment of the reservation known as Superior National Forest at the same time that a similar reservation, Quetico Park, was set aside just over the Canadian border in Ontario.

And now comes a proposition, initiated a couple of years back and at present being investigated by an international commission, to establish a series of dams in the series of lakes and rivers forming the international boundary between Ontario and Minnesota from a point about forty miles west of Lake Superior and extending to Rainy Lake. The purpose is to control the huge volume of water in this basin by damming the lakes in order to provide a more constant flow for power plants on the Rainy and St. Francis rivers.

Why should such a project be opposed? The main reason is that the Superior National Forest has been set aside for a state and national playground and the project will ruin a great part of this area for any such purpose. Raising the water in this long chain of lakes anywhere from one to sixteen feet (and one proposed dam is to be some eighty feet high) will kill the timber on the shores of the lakes, and the dead trees will give an air of desolation to the region for years to come, as anyone who has seen the results of raising a lake level, Lake Winnibigoshish, for ex-

ample, will agree. It does not require a lively imagination to picture the devastated appearance of these lakes as seen from the water with the shores fringed to a greater or less degree by dead standing or fallen timber. Lowering the lake levels in time of drought, as is proposed, to supply a more even flow to the power plants, will reduce and in some regions perhaps exterminate the fish, particularly the whitefish and trout, through the destruction of the fish eggs deposited near the shore. Islands and mainland will be inundated to varying degrees and endless suits for property damage are sure to result.

Is the development of this additional power, which we are informed will largely be used in Canada and the sum total of which is rather insignificant compared with other sources, worth the price, which will be the ruination of this ideal playground for the present and future generations?

### The Hospital Library and Service Bureau

The modern hospital is an outgrowth of a realization of the important part played by the institution in the lives of every one of us. Every physician is to a certain degree interested in one or more such institutions from the professional standpoint particularly. Few are the family units which do not at some time or other require the services of a hospital and only too often in a crisis. A realization of the importance of having hospitals well constructed, equipped and managed has gradually dawned upon the public at large.

In the interests of better hospital service in general there was established in Chicago in 1920, through the financial assistance of the Rockefeller Foundation, a Hospital Library and Service Bureau as a part of the American Conference on Hospital Service (an organization consisting of some twenty national associations in the hospital and health fields). Later, additional funds were supplied by the Carnegie Corporation and the Commonwealth Fund. The Bureau has also received from time to time donations from various associations and individuals interested in hospitals. Service is rendered entirely gratis to anyone active in hospital or public health work, whether a member of one of the component associations or not.

The Bureau has several departments. Information (not advice) is furnished on a great

variety of subjects relating to hospitals in general. The department of Hospital Construction has a file of the architects' plans of several hundred institutions which are at the disposal of trustees contemplating the construction of a hospital or addition. The reference library contains a most complete collection of hospital literature and a circulating library consisting of some 3,000 so-called package libraries. Bibliographies are also furnished upon request.

Those who saw the exhibit of the Bureau at the recent convention of the American Hospital Association in Minneapolis can better appreciate the scope of the work conducted by the Bureau. We are glad to give further publicity to this recent undertaking founded in the interests of better hospitals. Those seeking hospital information of any sort should address the Hospital Library and Service Bureau, 18 East Division Street, Chicago.

### Christmas Seals

In the multitude of thoughtful and helpful customs there is none more in keeping with the true spirit of Christmas than the purchase and use of tuberculosis Christmas Seals.

Inch by inch that age-old enemy—the dread White Plague, which the penny seals fight, is retreating. For centuries the first cause of death, it is now the fifth. Within a decade the death rate has been cut in half. Last year alone, it is estimated that over 1,300 lives were saved in Minnesota.

It is not only on tuberculosis that this remarkable campaign has had its effect. Since the first effort to teach people to sleep with their windows open and to avoid the common drinking cup down to the present day, when periodic medical examinations are being urged for all, the anti-tuberculosis program has led in virtually every effort to promote health. In fighting tuberculosis, every other disease has been fought, and the span of life has been increased.

But tuberculosis is still a powerful enemy. In the past ten years its victims in Minnesota have numbered over 22,000. Last year alone it killed 1,686 men, women and children of our State.

Once each year every person has a chance to aid in the Crusade to rid the nation of the greatest of all plagues by the purchase of Christmas Seals. This is a simple little action, neither ex-

pensive nor difficult, yet it returns dividends a thousand fold. Buy two of the gay little health seals in this sale for every one you purchased last year.

## OBITUARY

### Dr. Nellie S. Shulean

Dr. Nellie S. Shulean, 63 years old, one of the first women doctors in Minnesota and the first licensed doctor in Isanti county, died Saturday, October 22, at her home in Cambridge, Minn. She had been ill only a short time.

Dr. Shulean began practice 40 years ago at Cambridge, at a time when she had to minister to the whole countryside and often had to be druggist as well as doctor, making her own medicines.

Just as any man in the medical profession, Dr. Shulean went out in her horse and buggy in all kinds of weather, snowstorms, rain or sunshine, and by day or night to aid the sick.

This willingness to go where she was needed gained many friends, not only in Isanti county, where she lived, but in Kanabec, Anoka and Chisago counties as well.

Born in Cambridge, Dr. Shulean received her primary and high school education there and took a course in medicine at the University of Minnesota. After graduation she practiced in Cambridge but transferred her practice to Minneapolis for a period of 10 years and then went back to her home town.

The past two years she was resident physician at the state hospital for the insane at Somerset, Pa., giving up that position a month ago because of ill health. She returned home after leaving Pennsylvania.

Besides her regular practice, Dr. Shulean was known for her charity work and rehabilitation of girls. She was active in the Red Cross during the World war.

She was a member of the American Medical Association, the Medical Women's National Association and was a charter member of the Cambridge lodge of the Eastern Star.

Surviving her are one sister, Mrs. Isabel Rice of Cambridge, and three brothers, William and Frank Shulean of Cambridge and Andrew Shulean of Minneapolis. She was unmarried.

### Dr. Reuben D. Zimbeck

Dr. Reuben D. Zimbeck, a practicing physician in Minnesota for the past forty years, died at his home in Maynard, Minnesota, Wednesday, November 2, 1927.

Reuben D. Zimbeck was born at Sharon, Wis., April 23, 1857. He spent his boyhood and early manhood at Sharon, receiving his early education in the schools of that place. He graduated from the college at Carthage, Ill., took a course of two years at the University of Iowa and completed the medical course at Rush Medical School of Chicago, receiving his final degree as Medical Doctor in 1885. In 1886 he began the practice of his profession at Morton, Minnesota, continuing

there for four years. In 1890 he removed to Montevideo. He came to Maynard in the spring of 1915.

Since coming to Chippewa county thirty-seven years ago Dr. Zimbeck had been identified consistently with every public movement for the betterment of the community in which he lived. Perhaps his greatest achievements in a public way were made while a resident of the county seat at Montevideo. He served two terms as a member of the village council, one term as president. At the election of 1897 when he was made the president he received 292 votes out of a possible 295, which was an indication of the value which his fellow townsmen placed on his services to the town. He served as health officer in Montevideo for fifteen years and as county coroner for twelve years. He was an active member of the county and state medical societies and of the Odd Fellows, Workmen, Woodmen and Eagle Lodges.

As a physician Dr. Zimbeck was held in high esteem by members of his profession. As a student of modern medicine and methods Dr. Zimbeck was considered as having no superior among the older practitioners.

#### Dr. E. M. Clay

Dr. E. M. Clay, practicing physician in Renville county for more than 30 years, died suddenly Friday, November 4, at Olivia. He had left his home in Hutchinson earlier in the day to attend the funeral of Dr. Zimbeck at Maynard and came to Olivia to join Dr. Mesker on the trip from there. The train had stopped at Olivia and Dr. Clay, who up to that time had been apparently well, conversing with friends on the way, arose to put on his top coat when suddenly he fell over and expired immediately, presumably from heart trouble.

Edward M. Clay was born in Oronoco, Olmsted County, Minn., March 2, 1866. In 1884 the family moved to Hutchinson and three years later, in 1887, Dr. Clay went to Renville where he took the position of editor on a local newspaper, known as the Renville Weekly. He continued to edit this paper until 1889, when he took up the study of medicine at the medical college in Minneapolis, completing the course in 1893. He then returned to Renville and engaged in the practice of medicine, remaining there until two years ago, when he moved to Hutchinson.

During his long residence in Renville county, Dr. Clay took an active part in public affairs. He held the office of county coroner for twelve years and served as alderman in the city of Renville for several terms. He was a member of the board of health, a member of Camp Release Medical Association, the State Medical Association and the American Medical Association.

#### RESOLUTION OF CAMP RELEASE MEDICAL ASSOCIATION

WHEREAS, The Camp Release Medical Association has sustained a loss in the death of our colleague, Dr. E. M. Clay, one of the charter members of the society, who departed this life on November 4, 1927, at Olivia, Minnesota,

WHEREAS, he was one of the pioneer men of this society and always deeply interested in the society's

welfare, and all those things that were for the betterment of the profession,

THEREFORE, BE IT RESOLVED, that we, the members of the Camp Release Medical Association, express our appreciation for the years of devoted service and fellowship and extend to the saddened family the sympathy of the society.

RESOLVED, that a copy of the Resolution be embodied in the minutes of our society, and that a copy be sent to the family as a tribute in memory of our colleague.

G. H. MESKER,  
R. C. ADAMS,  
E. C. GAINES,  
Committee.

### REPORTS AND ANNOUNCEMENTS OF SOCIETIES

#### MINNEAPOLIS SURGICAL SOCIETY

The Minneapolis Surgical Society will meet in December at the home of Dr. Kenneth Bulkley. The following papers will be read:

1. "Bilateral Nephrolithiasis, An Unusual Case," Dr. Martin Nordland.
2. "Inguinal Hernia," Dr. Stanley R. Maxeiner.

At the November meeting of the Society, held at the home of the President, Dr. H. B. Sweetser, a paper was read by Dr. R. E. Farr on "A Simple Aseptic Hemostatic Method of Inverting the Appendix Stump."

#### CAMP RELEASE DISTRICT MEDICAL SOCIETY

The annual meeting of the Camp Release District Medical Society was held in Olivia, Minn., Thursday, October 13, 1927, with President Dr. A. A. Passer, of Olivia, presiding. About thirty-five physicians were in attendance.

Dr. Rood Taylor, Minneapolis, held a Pediatric Clinic, and presented a paper on "Jaundice in Infants and Children."

Dr. Chas. N. Hensel, St. Paul, held a Cardiac Clinic, and gave three case histories of asthma, with illustrated skin test results.

Dr. W. F. Braasch, president of Minnesota State Medical Association, addressed the society on "Renal Lithiasis," its diagnosis and treatment, and followed this by a splendid résumé of the activities of the state organization for the year.

Dr. R. C. Adams, of Bird Island, presented his theme on "The Management of the County Indigent" in a very helpful manner.

A vote of thanks was tendered the distinguished visitors for their valuable contributions to the program.

A business session followed, and the former officers were re-elected as follows: Dr. A. A. Passer, of Olivia, president; Dr. M. A. Burns, of Milan, vice president; Dr. L. J. Holmberg, of Canby, secretary-treasurer.

A resolution presented by Dr. Crandall, of Madison, expressing the sincere appreciation of the society, for the effort made by Dr. Comstock, of St. Paul, in attending and giving advice during the trial of "Dr.



Kanawana" of Bellingham, for practicing without a license, was adopted and ordered spread upon the minutes, and a copy sent to Doctor Comstock.

The business session was enlivened by the presence and admonitions of the chairman of the state legislative committee, Dr. H. M. Johnson, of Dawson.

Following the business session, President and Mrs. Passer acted as hosts at a bountiful repast at their home. Mrs. Lauer mann, of Olivia, entertained during the dinner, with several delightful violin selections.

#### LYON-LINCOLN COUNTY MEDICAL SOCIETY

At a meeting of the Lyon-Lincoln County Society held October 11, the following officers were elected:

F. D. Gray, Marshall, president;  
E. Engh, Cottonwood, vice-president;  
H. M. Workman, Tracy, secretary and treasurer;  
E. T. Sanderson, Minnesota, delegate; A. L. Vadheim, Tyler, alternate;  
W. H. Valentine, Tracy, censor for three years.

#### ST. LOUIS COUNTY MEDICAL SOCIETY

The following are the new officers of the St. Louis County Medical Society, who were elected Oct. 13, 1927:

President, Dr. J. R. Kuth, of Duluth;  
First vice-president, Dr. R. D. Gardner, of Eveleth;  
Second vice-president, Dr. D. E. Seashore, of Duluth;  
Secretary and treasurer, Dr. F. J. Elias, of Duluth;  
Delegate, Dr. F. Magney; alternate, Dr. O. Parker;  
Censors, Drs. J. Robinson, Robt. Forbes, and M. Fischer.

#### WRIGHT COUNTY MEDICAL SOCIETY

At the annual meeting of the Wright County Medical Society held at Buffalo, Tuesday, Oct. 11, the following officers were elected for the coming year:

President, E. Klaveness, Monticello;  
Vice-president, O. Peterson, Cokato;  
Secretary-treasurer, J. J. Catlin, Buffalo;  
Censor, V. Rosseau, Maple Lake;  
Delegate, A. G. Moffatt, Howard Lake; alternate, B. Swezey, Buffalo.

The November meeting was held at Monticello, Tuesday, Nov. 15. The program was devoted to a symposium on cancer, followed by a banquet at 6 p. m.

#### WEST CENTRAL MINNESOTA MEDICAL SOCIETY

The annual meeting of the West Central Minnesota Medical Society was held at Morris, Minn., Oct. 12, 1927, when the members of the society and their ladies were the guests of Drs. Caine, Cumming, Fitzgerald, Leuty and Ransom at a six o'clock dinner.

Dr. C. F. Ewing of Wheaton addressed the society on the topic of postgraduate work and medical economics. A general discussion followed.

Election of officers for the year 1928 resulted as follows: President, Dr. J. T. Leland, Herman; vice-president, Dr. L. M. Ransom, Hancock; secretary-treasurer, Dr. H. Linde, Cyrus.

Dr. C. F. Ewing, Wheaton, was elected delegate to state convention, and Dr. I. Oliver, Graceville, director for relief in disaster.

The ladies of the society organized an auxiliary at the home of Mrs. E. T. Fitzgerald.

### OF GENERAL INTEREST

Dr. Chester Sturges, formerly of Buffalo, is now practicing at St. Paul, Nebraska.

A daughter was born to Dr. and Mrs. N. C. Ochsenhirt, Rochester, Minn., on October 2.

Dr. D. R. Heetderks, formerly of Rochester, Minn., is now located at Grand Rapids, Mich.

Dr. and Mrs. E. P. Hawkins, Montrose, left in October for Miami, Fla., where they will spend the winter.

Dr. J. W. Thompson, Jr., Rochester, Minn., has gone to St. Louis, Missouri, where he will locate. His address will be Beaumont Medical Building.

Dr. and Mrs. H. F. Helmholz, Rochester, Minn., sailed from Montreal, in October, for Europe. They will return the latter part of December.

Dr. N. C. Thimsen has moved from Blooming Prairie, Minn., to Saint Paul, where he has opened offices for the practice of medicine at 1342 Thomas Street.

The annual conference of the secretaries of the component medical societies of the State Medical Association will be held in Saint Paul, Saturday, January 14, 1928.

The Council of the State Medical Association has appointed the following standing committee on University Relations: C. B. Wright, W. F. Braasch, H. M. Johnson, C. C. Kennedy and H. M. Workman.

Dr. Verne G. Burden of Philadelphia, a former fellow on The Mayo Foundation, has been awarded the F. M. Kirby fellowship in surgery. This fellowship offers an opportunity for research with special reference to physiology, and a portion of the time is given to teaching.

At the November meeting of the Minnesota Academy of Medicine Dr. Hilding Berglund, chief of the medical department, University of Minnesota, was elected an honorary member; Dr. Owen W. Parker of Ely, associate member, and Dr. John S. Abbott, Saint Paul, active member.

Dr. Jacob Markowitz of Toronto has come to The Mayo Foundation as first assistant in the Division of Experimental Surgery and Pathology. He attended the University of Toronto, receiving the degrees of M.B. in 1923 and Ph.D. in 1926. He has been engaged in research and teaching in physiology and biochemistry in the University of Toronto.

Dr. Robert E. Fricke has become associated with the Mayo Clinic in the Section on Radium Therapy. He attended Johns Hopkins University, receiving the degrees of A.B. in 1916 and of M.D. in 1920. Since 1920 he has been associate in radium and x-ray therapy at the Howard A. Kelly Hospital in Baltimore.

The enrollment at the University of Minnesota this year at the end of the first week was 10,459, an in-

crease of almost 500 over the enrollment at the same time last year. Each college shows an increase except those of dentistry, pharmacy, law and education. For the second successive year agriculture shows a gain, implying farm prosperity. The enrollment in the school of medicine was 601.

President Coffman of the University of Minnesota recently announced that twelve professors had resigned this year and that some had given as their reason the failure of the University to provide a plan whereby they and their families would be provided for in old age. The same reason was given by some of those sought for the vacant professorships. The president advocates the adoption of some such plan as has been adopted by many of the leading universities of the country.

The Council of the Minnesota State Medical Association at its last meeting decided not to have a scientific program next year, but only a meeting of the House of Delegates on Monday of the American Medical Association convention week in Minneapolis. As the American Medical Association will have an excellent scientific program it was thought best not to attempt one. The Council will meet on Sunday preceding the House of Delegates meeting. The Council also instructed the incoming president to appoint a Historical Committee to "gather data concerning the history of the Minnesota State Medical Association."

The second annual get-together meeting of the Buena Vista sanatorium board and the medical society of Wabasha county was held at the sanatorium at Wabasha Wednesday evening, Oct. 26. The event was sponsored by the sanatorium commission and the Wabasha County Medical Society. The guests included physicians of the two counties and past and present members of the sanatorium commission. Dr. W. J. Cochrane acted as toastmaster at the program of addresses and informal talks given following the dinner. The principal addresses of the evening were by Dr. C. A. Stewart, member of the faculty at the University of Minnesota, and by Dr. W. V. Lindsay, Winona health officer.

Work will be started in the spring on a three-unit addition to the University hospital to cost \$890,000, it has been announced.

The expansion is in line with a program for hospitalization and housing of crippled children under medical school supervision as provided for in the \$2,000,000 gift of William Henry Eustis. There will be \$250,000 of this gift utilized to help defray the new addition's cost.

Besides the Eustis hospitalization unit, the new addition will include the student health service and outpatient or dispensary units. It will be built as a west wing paralleling the cancer institute and the eye, ear, nose and throat clinic on the east side.

A \$28,000 roofhouse over the front part to house hospital internes will be one of the addition's features. At present the university dispensary is housed in cramped quarters in Millard hall basement, three blocks away from the hospital.

## NEW AND NON-OFFICIAL REMEDIES

The following articles have been accepted by the Council on Pharmacy and Chemistry:

### DEPREE COMPANY

Sulpharsphenamine-DePree in 0.1, 0.15, 0.2, 0.3, 0.4, 0.45, 0.6, 1.0, 3.0, Gm. Ampules.

### GILLILAND LABORATORIES, INC.

Typhoid Vaccine, 30 Ampule package.

### ELI LILLY & Co.

Ephedrine-Lilly

Inhalant Ephedrine Compound-Lilly

### PARKE, DAVIS & Co.

Erysipelas Streptococcus Antitoxin (Refined and Concentrated)-P.D. & Co.

### E. R. SQUIBB & SONS

Scarlet Fever Streptococcus Toxin-Squibb, 5 vial package (500, 2,000, 8,000, 25,000, 60,000 skin test doses)

Scarlet Fever Streptococcus Toxin-Squibb, 50 vial package (500, 2,000, 8,000, 25,000, 60,000 skin test doses)

### WINTHROP CHEMICAL Co.

Mesuroil

Emulsion Mesuroil, 20 per cent

### NON-PROPRIETARY ARTICLES

Ephedrine (base)

## TRUTH ABOUT MEDICINES

*Diphtheria Toxin-Antitoxin Mixture, 0.1 L+ (New and Non-official Remedies, 1927, p. 341).*—This product is also marketed in packages of 30 bulbs, each containing 1 c.c., representing ten immunizing treatments. Parke, Davis & Co., Detroit. (Jour. A. M. A., October 1, 1927, p. 1151.)

*Bromural.*—2-monobromisovalerylurea, obtained by the interaction of urea with bromisovaleryl bromide. Bromural is a nerve sedative which produces sleep in mild cases of insomnia without markedly affecting the circulation or respiration. It is claimed to be useful as a nerve sedative and for the purpose of inducing sleep in functional nervous disease. Bromural is not effective in cases of insomnia associated with pain, cough, angina pectoris or delirium. It is supplied in substance and in five grain tablets. E. Bilhuber, Inc., New York. (Jour. A. M. A., October 8, 1927, p. 1251.)

*Erysipelas Streptococcus Antitoxin Refined and Concentrated-P. D. & Co.*—An erysipelas streptococcus antitoxin (New and Non-official Remedies, 1927, p. 337) prepared by immunizing horses with cultures of streptococcus isolated from erysipelas. The potency of the product is declared in "units," a unit representing the amount of antitoxin required to neutralize one skin test dose of toxin. It is marketed in packages of one piston syringe containing 500,000 units. Parke, Davis & Co., Detroit. (Jour. A. M. A., October 15, 1927, p. 1335.)

## CASE REPORTS

Members are requested to report interesting and unusual cases for publication in this department. Many cases reported at hospital staff meetings and similar meetings are very instructive and worthy of publication.

### CONGENITAL DIAPHRAGMATIC HERNIA

REPORT OF CASE

G. P. DUNNE, M.D.  
Saint Paul

Necropsy should be performed in all cases of neonatal death, especially in those of spontaneous deliveries. By so doing, the obstetrician will, in many cases, avoid unjust criticism.

The comparative rarity of congenital diaphragmatic hernia, and the failure in diagnosis before death, is sufficient ground for reporting the following case.

Mrs. M. H., aged 17, a white primipara, was admitted to the hospital March 20, 1926, in actual labor, and with membranes ruptured.

Her family history was unimportant.

She had had pertussis, chicken pox, jaundice and influenza.

Her menses began at twelve years of age, and came irregularly from 28 to 40 days apart, with pain during the second and third day. The last period had been July 14, 1925, and the estimated date of confinement April 12, 1926.

*Physical Examination.*—Temperature 98.2, pulse 80, B. P. 106/70. A well developed and well nourished, white female. Head, neck, nose, throat, lungs, heart, G. I. and G. U. systems negative.

Fundus; Four fingers' breadth above the umbilicus.

Presentation: longitudinal vertex. Position L. O. A. Fetal heart 120 L. L. Q. Measurements: I. S. 24, I. C. 26, Troch 31, E. C. 20, T. O. 8.5.

After a labor of 13 hours and 10 minutes (first stage, 11 hours; second stage, 2 hours and 10 minutes), she delivered, spontaneously, a premature (36 weeks) male, cyanotic child.

Following delivery, the child took a few shallow gasps. Examination of chest showed the heart markedly displaced to the left. The right side of the chest appeared more prominent than the left and the percussion note was tympanitic. Breath sounds could not be heard any place over the chest. No gurgling was audible.

A diagnosis of atelectasis was made. Artificial respiration, tubbing, and adrenalin retained life for 67 minutes after birth.

*Necropsy Report.*—The subject is a well developed, small, slightly premature male child, showing marked lividity over the entire body. No edema or jaundice present, and no marks on the body.

*Peritoneal Cavity.*—The abdomen is practically empty. The sigmoid and descending colon extend from the right of the diaphragm down into the pelvis, but no other part of the intestine is visible. The entire posterior right half of the diaphragm is entirely absent and through this opening the colon passes.

*Pleural Cavities.*—These show no fluid nor adhesions, but the right cavity is entirely filled with intestines. The appendix is visible on the right side just above the diaphragm; the left cavity is entirely obliterated by the pressure from the distended right cavity.

The heart is normal in size and shape, but pressed over against the left distal wall by the intestinal mass in the right cavity. There are a few drops of fluid in the pericardium. Nothing of interest is found in the heart itself.

*Lungs:* Both lungs are very small and dark red in color. Gross section shows them to contain a very small amount of air in a few areas, but for the greater part they are solid and heavy and have never been distended.

The spleen and liver are normal and the gastrointestinal tract normal except for its unusual position.

The adrenals, kidneys and pelvic organs were not examined.

*Diagnosis:*

1. Congenital diaphragmatic hernia.
2. Intestines in right pleural cavity.

619 Hamm Building.

### COMPOUND DISLOCATION FRACTURE OF DISTAL PHALANX OF FINGER

REPORT OF CASE

L. R. BOIES, M.A., M.D.  
Minneapolis

A professional baseball catcher received a foul tip on the end of the middle finger of his throwing hand, splitting the nail transversely just distal to the matrix, with a fracture of the distal phalanx just beyond the attachment of the extensor digitorum communis tendon. The fracture line extended into the joint (Fig. 1) and the lateral ligaments of the joint were torn about half way toward the palmar surface on each side; the joint was thus exposed and open.

Both the index finger and the fourth finger on the same hand presented the picture of "mallet finger" from previous injuries. Loss of function through stiffness in the joint, or loss of extensor power in the present injury, would seriously impair his throwing ability, thus affecting his future livelihood as a baseball player, and in addition cause considerable financial loss to the club owning him.

*Treatment:* First aid treatment consisted in the free application of two per cent mercurochrome to the wound.



Fig. 1. Anterior-posterior and lateral plates made before reduction of the compound dislocation fracture of the distal phalanx of the middle finger of the right hand.

About one hour after the injury, the player reported for surgical attention. The finger and the adjacent hand were carefully cleansed with benzine and then ether, followed by further preparation with Scott's solution of mercurochrome. Under block anesthesia with 1 per cent novocaine and aseptic technic, after the application of a rubber tourniquet to the base of the finger, the torn proximal half of the nail was removed, not disturbing the matrix and leaving the distal half

of the nail, which was attached. A careful debridement operation of the ragged edges of the wound was performed, care being taken to identify the separated ends of the extensor digitorum communis tendon and attached bone. The exposed joint cavity was then repeatedly flushed with warm normal sterile saline and the flushing was repeated using a solution of 2 per cent mercurochrome.

Gentle traction on the distal phalanx combined with

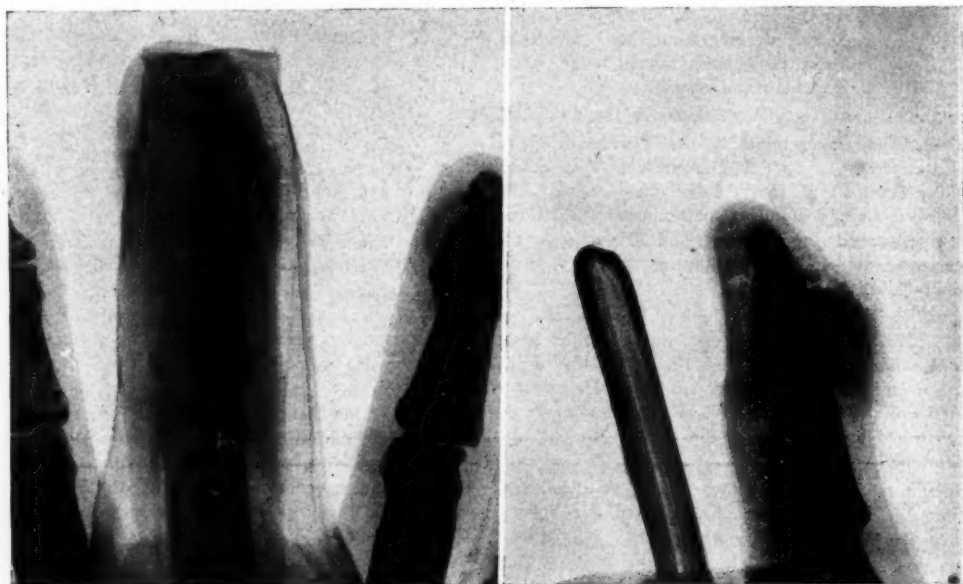


Fig. 2. Anterior-posterior and lateral plates of the same finger after reduction. The lateral view shows the splint in place for maintaining hyperextension to keep the reduced fracture in position and release tension on the extensor digitorum communis tendon.



medial and palmar pressure to the distal phalanx reduced the dislocation and the fracture (Fig. 2).

A splint extending from the middle of the palm beyond the end of the injured phalanx was padded so as to place the finger in hyperextension, especially of the distal phalangeal joint. A second palmar splint was applied to place the wrist in dorsiflexion with the purpose of avoiding all tension possible on the extensor digitorum communis tendon on the base of the distal phalanx.

*After-care:* Dressings were changed daily during the first week; the surface of the wound was cleansed with alcohol, followed by the application of 2 per cent mercurochrome. The wound had sealed over by the fourth day, with no evidence of infection. The palmar splint on the wrist was removed on the eighth day, the splint to the finger on the tenth day. Hydrotherapy in the form of warm hand baths for twenty minutes three times daily was then started. A small protective splint from a tongue blade was placed on the palmar surface of the finger. Further splinting was discontinued on the twelfth day and active and passive motion started with continuation of the water baths. The patient began to handle a base ball and to throw carefully on the eighteenth day. Gradual increase in the amount of use of the finger continued until the thirty-fifth day, when he returned to the game. At this time he experienced only occasional soreness in the tip of the finger and as there were no signs of nail regeneration yet, the area from which the nail had been removed was slightly tender. The injury, however, seemed not to have in any way caused any loss of playing ability, and incidentally on the following day after his return to the game he was able to equal the existing world's record of three home runs in a single game. Examination two weeks later revealed regenerating nail. The range of active motion in the injured joint measured approximately thirty-five degrees as compared with the normal range of active motion, which is about forty-five degrees. Use of his extensor tendon as affecting the distal phalanx had not been impaired. Full normal range of motion will probably be regained in time.

*Comment:* The results obtained with the treatment in this case would indicate that:

1. The operation of debridement as developed for large wounds in the World War should be practiced in small wounds of this type where maximum recovery of function is desired.

2. Mercurochrome in 2 per cent solution is a useful antiseptic for joint cavities.

3. The principle of completely releasing tension on the tendinous attachments, as effected in this case by maintaining hyperextension with splints, insures the greater possibility of regaining healing in proper position of the detached tendons for the recovery of function.

4. Early motion as advocated by Wilhelmj insures greater probability of recovery of function.

## PROGRESS

Abstracts to be submitted to Section Supervisors.

Members are urged to abstract valuable articles which they run across in their reading and send the abstracts to the physicians in charge of the respective sections. In order to avoid duplication it would be well to communicate with one of the section supervisors before the article is abstracted.

## SURGERY

### SUPERVISORS:

DONALD K. BACON,  
LOWRY BLDG., ST. PAUL

VERNE C. HUNT,  
MAYO CLINIC, ROCHESTER

THE STATUS OF ENTEROSTOMY IN THE TREATMENT OF ACUTE ILEUS: E. T. VanBuren and B. C. Smith (Archives of Surgery, August, 1927, XV, 288-297). Enterostomy has long been considered a life saving procedure in acute ileus, especially high jejunostomy. Certain facts have caused these recommendations to be questioned. The authors have found a high mortality rate in their series of cases with enterostomy. They have not found incontrovertible proof that enterostomy has lowered the mortality rate in cases of acute ileus.

From their table the average mortality rate for patients with acute ileus on whom enterostomy has been performed is 19% higher than that for the entire series.

In Gibson's series of 1,000 cases (1900) the mortality rate of the enterostomy group was 26% higher than that of the non-enterostomy group; in the author's series of 1,089 cases, 28% higher. In Gibson's series, enterostomy was performed in 19% of the cases and in the author's series, 32% of cases. The operation has been reserved for the cases in which the patient is the sickest. The authors have considered the fact that it would be fallacious to compare the mortality rate of the entire enterostomy group with that of the entire non-enterostomy group in any series until it is determined whether each comprises the same percentage of late cases as does the other. The mortality rate depends primarily upon the time at which the operation is performed rather than the type of operation. They have compared the late enterostomy group against the late non-enterostomy group (72 plus hours) and find the former much higher: 60% mortality for the enterostomy group and 47.8% for the non-enterostomy group.

A poor choice of cases and additional shock due to added surgical procedure, such as exploration, may account for the higher mortality rate. In cases with advanced ileus a lethal dose of poison has been absorbed and it is useless to expect the condition of the patient to improve after enterostomy. Surgical shock is added to fatal chemical poisoning. The primary object of enterostomy is to secure drainage. If enterostomy is done in time but drainage not secured, the procedure is without value.

It appears that enterostomy has had little influence on the general mortality rate of all cases in a series, but there is some evidence that the mortality has been lowered by this procedure. Early and late cases must be considered and it must be used in a larger percentage of total number of cases in a series, and more often as a primary step to further treatment.

The actual value of the procedure must be established by statistical proof. Statistics up to the present time do not afford a suitable comparison. Coöperation of those interested in acute ileus, in tabulating their data as to late and early cases, both with and without enterostomy, so that a favorable comparison could be made, would help greatly in establishing the true value of enterostomy in acute ileus.

LLOYD T. SUSSEX, M.D.

**TREATMENT OF POSTOPERATIVE SUPPURATIVE PAROTIDITIS:** W. H. Fisher (Ann. of Surg., Vol. LXXXVI, 445). The author calls attention to a previous article in which he classified postoperative infective parotiditis into three types: (1) acute parotiditis or simple inflammation; (2) acute suppurative parotiditis; and (3) gangrenous parotiditis. In the previous article he drew the following conclusions:

1. Every case is a potential lethal factor until it proves itself benign.
2. To await spontaneous evolution is jeopardizing life.
3. Differential diagnosis of types suggests the method of relief, medical or surgical.
4. When surgical, operate early, with free incision and open drainage.

The author gives four case reports in which daily injections of 5 c.c. of mercurochrome intravenously were given from the onset. The process is usually a staphylococcus infection and mercurochrome frequently aborts the process entirely or greatly modifies its severity. If, after the second or third injection of mercurochrome, there is no improvement, the case assumes surgical aspects. The gangrenous types are usually fatal.

PAUL G. FLOTHOW, M.D.

**RECURRENT MULTIPLE OSTEOMYELITIS DUE TO STAPHYLOCOCCUS AUREUS:** R. Mc. E. Schauffler (Jour. Bone and Joint Surg., 1927, IX, 740-747). The author describes a type of osteomyelitis characterized by remissions and exacerbations. The disease usually begins in an acute form in childhood and may last to late adolescence or longer. Sev-

eral severe lesions appear in rapid succession and usually involve the femora, humeri or tibiae.

The cancellous bone of the upper tibia or upper femur usually constitutes the long persistent focus of infection from which the later periosteal and deep fascial infections have their origin. The acuteness of the process varies in different cases.

Twenty cases of multiple osteomyelitis are reported, seven of the severe type with wide-spread lesions and many abscesses. Thirteen had two or more widely separated bone lesions and were characterized by chronicity and recurrence with occasionally a periosteal or fascial abscess. The organism present is usually staphylococcus.

HAROLD E. SIMON, M.D.

**LIGATION OF THE FEMORAL ARTERY BELOW THE ORIGIN OF THE PROFUNDA FEMORIS IN THE TREATMENT OF OBLITERATIVE ENDARTERITIS OF THE LEG:** T. E. Neill (Ann. Surg., Vol. LXXXVI, 425). Neill points out the fact that the question of whether or not tissue death takes place in a limb affected by obliterative endarteritis depends entirely upon the formation of collateral circulation. The process of the endarteritis which plugs the vessels is a slow one as is also the establishment of collateral circulation. If the latter process is the more rapid, death of tissue or gangrene does not take place.

The surgeon usually sees the disease late in its course when gangrene is already present and amputation is indicated.

Lewis and Reichert introduced ligation of the femoral artery in this condition, reasoning that it would both inhibit the rate of occlusion of vessels and stimulate the development of collateral circulation. The femoral artery is ligated just proximal to Hunter's canal. Very good results have been obtained and patients have been saved from amputation. A case report is included.

PAUL G. FLOTHOW, M.D.

**MOVABLE BULLETS IN THE SPINAL CANAL:** Leo P. Bell (Jour. Bone and Joint Surg., 1927, IX, 639-647). Trauma to the spinal cord, resulting from a bullet wound, is rare in civil life. The immediate mortality and end-results depend upon the location of the injury, the amount of trauma to the cord, the extent of intra- and extra-theal hemorrhage, the length of time elapsing before laminectomy is done for relief of pressure on the cord, the amount of infection present, and the injury to structures of the body other than the cord.

Bullet wounds in the cervical region cause a much higher mortality and result in many more complications than do wounds in the lumbar region.

As soon as shock has passed, laminectomy should be done to prevent pressure destruction of the cord and to allow relief of tension by swelling and edema. When a bullet is allowed to remain in the canal for a long

time, it becomes surrounded by organized blood clots, which may result in pressure disturbance to the filaments of the cauda equina.

It would seem that all bullets entering the dural sheath in the lumbar region are movable, or potentially so, until they become stationary from inflammatory reaction and fibrosis, which probably requires four or five months.

To guard against errors in localization due to movements of the bullet, the author suggests that stereoscopic x-ray pictures should be made just before placing the patient on the operating table; that there should be the least possible movement of the patient's body after roentgenological localization; that local anesthesia should be used, and that the head of the table should not be elevated to allow the bullet to gravitate into the operative field because that may lead to an extensive and serious loss of cerebrospinal fluid.

HAROLD E. SIMON, M.D.

## PEDIATRICS

### SUPERVISORS:

CHESTER A. STEWART,  
LA SALLE BLDG., MINNEAPOLIS

ROY N. ANDREWS,  
MANKATO CLINIC, MANKATO

**THE THERAPEUTICS OF THE CARDIAC CHILD:** J. Epstein, M.D. (*Arch. of Ped.*, Sept., 1927). Heart disease in early childhood is usually congenital. Acquired heart disease during the first two or three years of life is mainly due to septic infection.

Insufficient wholesome food, scanty clothing, unhygienic care, cold and damp dwellings, exposure to bad weather and poverty in all its ramifications lay the foundation for heart disease. Complete physical and mental rest will relieve the heart of a great deal of its extra work. Prolonged rest in bed will favor restitution of the heart to its normal condition. It will reduce inflammation, the number of heart beats, and the constant pounding of the blood against the diseased valves during cardiac contraction. There is no need for digitalis in the acute stage with perfect compensation. An ice bag to the precordium, salicylates and codeine form the necessary first aid therapeutics. After the child has received a thorough course of salicylates, guaiacol carbonate and quinine should be given. With the subsidence of the fever and the improvement of the symptoms, calcium salts, especially calcium glycerophosphate, iron citrate or carbonate and arsenic, are indicated.

R. N. ANDREWS, M.D.

**INFANTILE ECZEMA—A PHYSICAL OR COLD WEATHER ALLERGY:** M. S. Picard, M.D. (*Arch. of Pediatrics*, Sept., 1927). Seasonal appearance of eczema is a definite phenomenon. Pediatricists believe it to be some manifestation of food irritation such as faulty fat metabolism, as in Czerny's exudative diathesis, or protein irritation, as in Schloss' outstanding work on food allergy. The idea was confirmed that the transmission of foreign proteid through the milk produces eczema in the suckling. O'Keefe, in a study of 45 cases of eczema in the breast-fed child, found 17 cases showing a reaction to one or more of the egg proteins. Six showed a reaction to cow's milk. The author does not believe this can fully explain the predominance of eczema in the breast-fed child. In mother's milk we reach the millennium of nutritional perfection, a perfect food, specially prepared by nature, true to its own species, yet in breast-fed children are found the most stubborn and intractable cases of eczema.

If we take a child off breast milk and put it on cow's milk, the eczema persists. The author is convinced that food allergy is of minor importance only and that the real cause must be sought in some other sphere. He believes cold weather allergy is the most important factor. Sensitiveness to cold does not develop with the first appearance of winter. A certain time is necessary for this sensitiveness to appear, in a sense comparable to serum reactions, but, once established, it is constant, only to be relieved by warm weather.

Like all other allergies, the susceptibility to cold is not permanent. The great majority of children lose their susceptibility the second winter, the succeeding winter shows fewer cases and very few carry symptoms into the fourth winter. Fully 80 per cent fail to recur the second winter.

The mask smeared with zinc oxide ointment or tar ointment is a mechanical protection from cold. It gives the same protection that long distance swimmers get by smearing their bodies with a heavy coating of grease.

R. N. ANDREWS, M.D.

## ASTHMOLYSIN

Asthmolysin is, according to the advertising, "a combination of the suprarenal and pituitary hormones in distinct proportions," prepared by a "special method." There appears to be no scientific evidence to warrant the use of pituitary in bronchial asthma. Epinephrine is frequently used in some forms of asthma, but may be had pure and need not be prescribed in a secret preparation containing an undetermined amount. The 1927 Asthmolysin circular consists of testimonials from 121 physicians, of whom thirty-five are Fellows and thirty-three are neither members nor Fellows. Such testimonials, given for a semi-secret preparation of unscientific character, are no credit to those members of the supposedly learned profession that gave them. (*Jour. A. M. A.*, October 1, 1927, p. 1170.)

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## ROENTGENOLOGY

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**SUPERVISORS:**  
**LEO G. RIGLER,**  
**MPLS. GEN'L HOSPITAL, MINNEAPOLIS**  
**A. U. DESJARDINS,**  
**MAYO CLINIC, ROCHESTER**

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**A CASE OF "IVORY BONE VERTEBRA"** (Marble-bone?) in Lympho-Granulomatosis: O. Hultén (*Acta Radiologica*, Vol. VIII, p. 252, July, 1927). A case of lymphogranulomatosis is described in which marked changes in the vertebrae were found. A destructive process in several of the dorsal vertebrae was found on roentgen examination with compression of one of them. On microscopic examination after autopsy, these were found infiltrated with lymphoid tissue with marked atrophy of the bone. In one of the lumbar vertebrae, on the other hand, a productive process was found, the body being extremely dense, resembling an "Elfenbeinwirbel" (probably "marble-bones" or osteosclerosis). This vertebra on microscopic examination showed increase in bone substance and calcium resembling closely the picture seen in osteoblastic carcinoma metastasis of slow growing type. This type of bone change associated with Hodgkin's disease has not been heretofore reported.

The author believes that the increased density and the bone sclerosis seen in this case, as well as in the slow growing metastasis from carcinoma of the prostate or breast, is due to a healing tendency which these tumors have. He advises more routine roentgen examinations of the skeleton in cases of Hodgkin's disease.

LEO G. RIGLER, M.D.

**ANNULAR SHADOWS IN THE LUNGS CAUSED BY SUBPLEURAL EMPHYSEMA:** S. Arnell (*Acta Radiologica*, Vol. VIII, p. 252, July, 1927). The author reports here a case of prolonged asthma showing numerous large and small annular shadows in the lungs on roentgenologic examination. These were of such a character as to simulate tuberculous cavities if they had been located in the upper lobes. On post mortem examination, they were found to be due to subpleural and interstitial emphysema and to blebs in the pleural sac. The case is of interest as it substantiates with autopsy proof the statements of Miller and others that this may be one of the causes of annular shadows.

LEO G. RIGLER, M.D.

**TWO CASES OF HODGKIN'S DISEASE WITH BONE DESTRUCTION:** S. Arnell (*Acta Radiologica*, Vol. VIII, p. 259, July, 1927). The author describes two cases of Hodgkin's disease, in one of which

the sternum and in the other several ribs and the bodies of several vertebrae showed evidence of infiltration on roentgen examination. There was bone destruction and also some periosteal new bone production. The author believes it is virtually impossible to distinguish the roentgen picture of Hodgkin's infiltration in bone from carcinomatous metastasis to bone.

LEO G. RIGLER, M.D.

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## EYE, EAR, NOSE AND THROAT

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**SUPERVISORS:**  
**VIRGIL J. SCHWARTZ,**  
**PHYS. & SURG. BLDG., MINNEAPOLIS**  
**E. L. ARMSTRONG,**  
**FIDELITY BLDG., DULUTH**

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**RADIUM IMPLANTATION IN ESOPHAGEAL CANCER:** Joseph Muir (*Laryngoscope*, 37: 660, September 1927). Cancer of the esophagus is generally regarded as the most hopelessly incurable of malignant lesions. None of the forms of treatment which have proved successful in combating cancer elsewhere in the body have heretofore been possible of application to the esophagus. Radium has been even less beneficial than surgery. Three prime drawbacks to this use of radium have always existed; first, the difficulty of placing it accurately; second, the practical impossibility of maintaining it in position long enough to be effectual, and third, the great danger of burning the tissues, which will induce sloughing and fistula into the mediastinum—invariably a fatal accident.

To obviate these difficulties the author has elaborated a technic of radium implantation through a specially designed esophagoscope which can be readily carried out by anyone experienced in the use of this type of instrument. The field of operation is illuminated and an implanter passed through the tube, so that each radon seed may be placed in full view, and the entire lesion accurately mapped out and evenly implanted. The radioactive center employed is a removable platinum radon seed, which offers the double advantage of being so screened that it will not induce necrosis, and the possibility of removal by means of an attached thread so that no foreign bodies are left in the tissue after the contained radium emanation has entirely decayed. The entire procedure is facilitated if done under the fluoroscope, though this is not absolutely essential.

The results in the small series of cases so far treated by this method have been highly gratifying, and although no permanent results can be reported before the lapse of five years, the author feels that the method merits a wide trial, even if it proves to do no more than prolong lives which otherwise will be very shortly terminated.



**PEDIATRIC ASPECTS OF OTOLARYNGOLOGY:** McKimm Marriott, M.D., St. Louis, Missouri (Annals of Otolaryngology and Laryngology, September, 1927, pages 686-692). Many important conditions in children and infants are primarily results of infections, processes of ears, nose and throat.

Pain-headache, purulent nasal discharge may not be present in diseased sinuses and the sinusitis is found only by careful search. Mastoiditis with pain, fever, redness and swelling is easily diagnosed, but it may occur in infants with none of the classical signs.

An infant whose food is correct and still does not thrive, or who develops gastro-intestinal symptoms, is suffering from some infection and the food does not need to be altered.

The infection is very likely to be in the ears or nose. Otitis media is the most frequent cause of gastro-intestinal disturbances. The drum may not even be red or bulging. There may be only a lack of lustre of the drum. Where the symptoms persist following a paracentesis the mastoid antrum is probably involved with swelling of mucosa, blocking off the antrum so that it cannot drain into the middle ear. Then the posterior superior canal wall will sag just external to the drum.

Antrotomy should be performed at that point, and will be followed by prompt relief of symptoms.

E. L. ARMSTRONG, M.D.

## BOOK REVIEWS

### BOOKS RECEIVED FOR REVIEW

**INTERNATIONAL CLINICS,** Edited by Henry W. Cattell, M.D. Vol. III. 37th Series, 1927. 311 pages. Illus. Philadelphia and London: J. B. Lippincott Co., 1927.

**MODERN MEDICINE.** Sir William Osler, Bart., M.D., F.R.S. Re-edited by Thomas McCrae, M.D., and Elmer H. Funk, M.D. Vol. V. 948 pages. Illus. Philadelphia: Lea and Febiger, 1927.

**AMERICAN MEDICINE AND THE PEOPLE'S HEALTH.** Harry H. Moore, Public Health Economist, U. S. P. H. S. With an introduction by the Committee of Five. 647 pages. Illus. Cloth, \$5.00. New York: D. Appleton and Company, 1927.

**MANUAL OF NORMAL PHYSICAL SCIENCE.** Wyndham B. Blanton, B.A., M.A., and M.D. Price \$2.50. St. Louis: C. V. Mosby Company, 1927.

This is a true manual of physical science. It is written in outline form, orderly and interestingly arranged. The book presents a good brief review of normal anatomy and physiology, covering the essential features of the entire body. The book was assembled primarily for the use of students, but after reviewing its contents one is impressed that it is of great value to the men out in practice, because of its

thoroughness and yet brevity. The author concludes his book with a chapter on the order of physical examination. This is an outline on procedure and is well done. He also warns "that a logical order should be rigidly adhered to," citing, "There is no surer road to errors of omission than indifference to this point." Experience bears this out. As a rule, it is not too careful examination, but rather the insufficient examination, that results in failure and regret. The book as a whole is well worth its price, for it leaves the physician better equipped to examine the patient.

A. E. FLAGSTAD, M.D.

**INTERNATIONAL MEDICAL ANNUAL. A Year Book of Treatment and Practitioner's Index. Forty-Fifth Year.** 560 pages, 81 plates, 77 illus. Cloth, \$6.00. New York: William Wood and Company, 1927.

This is the Forty-fifth consecutive yearly volume of the *Medical Annual*. In this volume is a review of the year's work on the treatment of disease, attempting to give all that is new and approved in therapeutics. The articles are concise and clear and the material has been well chosen by the editors and contributors.

An attempt to write a review of any of the articles themselves would be futile as the volume is a ready reference for all branches of medicine and should be personally seen to be appreciated.

A. E. CARDLE, M.D.

**LECTURES ON INTERNAL MEDICINE.** (Delivered in the United States in 1926.) Knud Faber, M.D., Professor of Internal Medicine, University of Copenhagen, Denmark. With 43 Figures and Charts. 147 pp. Cloth, \$3.00. New York: Paul B. Hoeber, Inc., 1927.

This number contains four lectures given by Dr. Knud Faber, Professor of Internal Medicine, University of Copenhagen, Denmark, while on a visit to the United States.

The first is on the "Etiology and Pathogenesis of Achylia Gastrica," an excellent discussion of the various theories of achylia and a discussion of the results of his own investigations. Dr. Faber believes that there is nothing remarkable about the disease and that it is due to disease of the gastric mucous membrane with its extensive glandular apparatus, and that the natural term for the disease is "gastritis," an inflammatory disease of the gastric parenchyma.

The second paper, "The Intestinal Origin of Pernicious Anemia," is a discussion of the theories of pernicious anemia, giving his view of the theories and attempting to show that achylia gastrica (anacidity) is the most frequent but not the only cause of pernicious anemia and is associated with a continually recurring intestinal intoxication from protein toxins.

"Benign Glycosuria," the third article, is chiefly a discussion of blood sugar threshold with considerable ex-

perimental evidence to show that in the same individual it constantly maintains a definite position.

The fourth article is a paper of history called the "Historical Outline of Medical Therapy." It is very interesting and enjoyable to read.

A. E. CARDLE, M.D.

**DISEASES OF THE DIGESTIVE ORGANS—DIAGNOSIS AND TREATMENT.** Charles D. Aaron, M.D., Professor of Gastro-Enterology and Dietetics, Detroit College of Medicine and Surgery; Professor of Gastro-Enterology, Detroit Post-Graduate School of Medicine. Fourth Edition. 927 pages. Illustrated. Cloth, \$11.00. Philadelphia: Lea & Febiger, 1927.

The fourth edition of this book is a thorough revision of this standard work. As the title indicates, the subject matter deals with diseases of the digestive tract and associated organs, with special attention to diagnosis and treatment. The newer methods of clinical and laboratory investigation have been included and the principles and details of technic accurately described. All well-recognized methods of treatment are considered and dietetic management carefully outlined. A special chapter is devoted to hydrotherapeutic measures. The chapters on Diseases of the Liver, Bile Ducts and Gallbladder have been entirely revised and brought up to date.

The book is well written, easily readable, profusely illustrated, and contains some excellent roentgenogram reproductions. It is not only of assistance to the

gastro-enterologist but a good reference work for the internist, surgeon, and general practitioner.

PAUL H. ROWE, M.D.

**ELECTROTHERMIC METHODS IN NEOPLASTIC DISEASES.** J. Douglas Morgan, B.A. and M.D. Price \$2.50. Philadelphia: F. A. Davis Company, 1927.

The author confines his work to a study of electrothermic therapy. He briefly reviews the historical phase of the subject and defines various terms associated with electro-therapy. Chapter III is devoted to a consideration of surgical diathermy, history, terminology and usage. Chapter IV is devoted to apparatus. Chapters V and VI consider electrodesiccation and electrocoagulation, defining these terms and illustrating their usage with the type of cases applicable to each. Chapter VII considers the general summary of these methods. Chapter VIII considers tissue cutting by high frequency current.

The author brings together throughout his entire book a rather complete review of all current articles pertaining to this special field of medicine. According to Dr. Morgan there are definite conditions in which electrothermic methods have a distinct advantage over any other procedure. This book is well worth reading for it leaves one better equipped to proceed in an intelligent manner in this particular phase of electrotherapy.

A. E. FLAGSTAD, M.D.

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## THE MINNESOTA STATE MEDICAL ASSOCIATION

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# Product and Policy

BETTER BABIES

RESPONSIBILITY in infant feeding necessitates unmolested control of the diet.

That Mead's Dextri-Maltose, cow's milk and water has given good results over a period of years in feeding the majority of infants is due to the policy that entrusts its indication and the control of its use to the doctor alone.

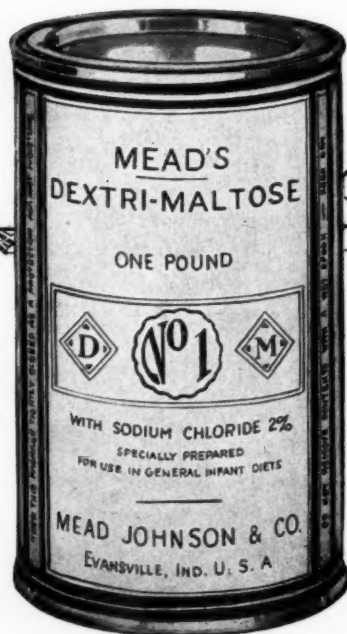
And so it has become known among physicians as a dependable infant diet material to be used in cases where gains in weight are desired, where nutritional disturbances are to be avoided, or where tolerance for sugars has been lowered.

Mead's Dextri-Maltose is the result of a natural conversion, i. e., by the action of the enzymes of pure barley malt upon cereal starch. It is to be used with a natural food, cow's milk diluted with water which can only be prescribed in the proper proportions by the doctor who has a knowledge of the individual infant in his care.



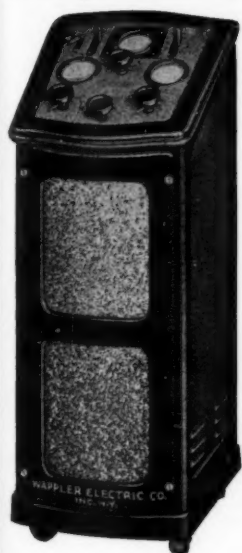
## THE MEAD POLICY

Mead's Infant Diet Materials are advertised only to physicians. No feeding directions accompany trade packages. Information in regard to feeding is supplied to the mother by written instructions from her doctor, who changes the feedings from time to time to meet the nutritional requirements of the growing infant. Literature furnished only to physicians.

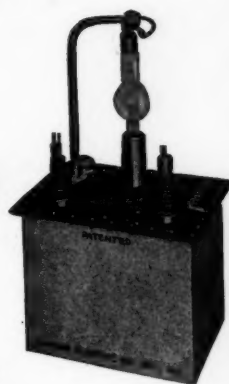


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